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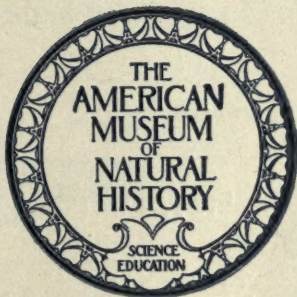
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- No. 11. Page 5, line 16 from top, read oölitic for colitic.
- " 11. Page 9, in table, line 12 from bottom, read *Ctenacanthus* for *Ctenocanthus*.
- " 20. Page 1, heading of new species, read *Ichthyomys* for *Ichthyomys*.
- " 21. Page 11, line 2 from top, read June 19 for July 19.
- " 23. Page 16, line 9 from top, read 1 ♀, Regnier for 1 ♂, Regnier; line 16 from bottom, read ♀ for ♂.
- " 24. Page 15, line 11 from bottom, Cheyenne Pass is in Wyoming, not Colorado.
- " 33. Page 5, line 2 from top, read morphological for morphyological.
- " 33. Page 8, line 10 from top, read end for and.

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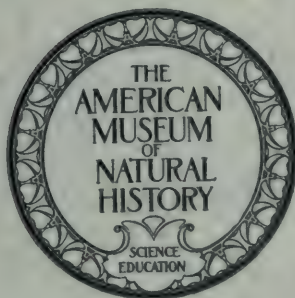


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No. 1

THE EVOLUTION, PHYLOGENY AND CLASSIFICATION OF THE PROBOSCIDEA

BY HENRY FAIRFIELD OSBORN



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THE EVOLUTION, PHYLOGENY, AND CLASSIFICATION OF THE PROBOSCEIDA

BY HENRY FAIRFIELD OSBORN

The following is the quadruple branching indicated in classifications of the Proboscidea previous to 1910 (Osborn, 'Age of Mammals'):

ELEPHANTIDÆ—Gray, 1821; Zittel, 1891

MASTODONTIDÆ—?Mastodonadæ Gray, 1821

DINOTHERIIDÆ—Bonaparte, 1845; Zittel, 1891

MÆRITHERIIDÆ—Andrews, 1906

1.—PRIMARY DIVISIONS

In December 1917, the author presented before the Palæontological Society a paper entitled 'A Long-jawed Mastodon Skeleton from South Dakota and Phylogeny of the Proboscidea.'¹ This included a polyphyletic theory of the Proboscidea more or less fully anticipated by previous authors but more radical. This branching, as extended by Osborn in 1910 and 1917, is as follows:

MASTODONTINÆ—Osborn, Age of Mammals, 1910, p. 558

ELEPHANTINÆ—Osborn, Age of Mammals, 1910, p. 558

BUNOMASTODONTINÆ—Osborn, 1918, p. 134. Defined to contain three main phyla, originally termed (Osborn, 1918, p. 136): 1, Longirostrinæ; 2, Rhynchorostrinæ; 3, Brevirostrinæ

STEGODONTINÆ—Osborn, 1918, p. 135 = Stegodonts of southern Asia

LOXODONTINÆ—Osborn, 1918, p. 135 = African and Eurasiatic loxodonts

EUELEPHANTINÆ²—Osborn, 1918, p. 136 = Mammoths of Eurasia and North America

Of the above branches it now appears that the Bunomastodontinæ is a group rather than a subfamily and must be split up into the three subfamilies provisionally termed (1, 2, 3) above. Adding the *Mæritheriidæ* and the *Dinotheriidæ*, this would divide the Proboscidea into ten branches.

¹Bull. Geol. Soc. Amer., XXIX, No. 1, March 1918, pp. 133-137.

²The term Euelephantinæ is invalid, because the genus *Euelephas* is invalid; the term *Mammontinæ* (i. e., *les mammons*, the mammoths) may be substituted.

In continuing the study of the Proboscidea since 1917, aided by recent observations of Lull, Matthew, Mayer, Schlesinger, Pilgrim, Barbour, and many others, it is the opinion of the author that the polyphyletic theory of the Proboscidea is not only confirmed but that the phyla are more numerous than the ten branches already named and are geologically far more ancient than appeared in 1917.

As regards the rank of the four primary divisions of the Proboscidea which have hitherto been discovered, they are certainly more profound than the four sections of the Rodentia, viz.: I, Sciuromorpha; II, Myomorpha; III, Hystricomorpha; IV, Lagomorpha. They are also more profound than Osborn's four main divisions of the Perissodactyla, viz.: I, Titanotheroidea; II, Hippoidea; III, Tapiroidea; IV, Rhinocerotioidea.

With the reservations, first, that we should not expect to find different orders of mammals subdivided into branches of equal rank and, second, that the subdivisions of the Proboscidea are either of subordinal or of superfamily value, we may adopt as the four primary divisions:

- I. MÆRITHERIOIDEA typified by the *Mærittherium* in the Oligocene of North Africa
- II. DINOTHERIOIDEA typified by the Miocene and Pliocene *Dinotheres* of Eurasia
- III. MASTODONTOIDEA to include the *Bunomastodontidæ*, new family, and the *Mastodontidæ*
- IV. ELEPHANTOIDEA to include the *Elephantinæ*, *Loxodontinæ*, *Stegodontinæ*, and *Mammontinæ*

I.—Mærittherioidea

Renewed study of *Mærittherium* by Osborn and Matsumoto entirely confirms Andrews' original opinion that *Mærittherium* belongs in the order Proboscidea, as well as Osborn's opinion that it stands very far apart from the other proboscideans and is not directly or indirectly ancestral to either of the other three groups. The enlargement of the second upper and lower incisor teeth into mutually abrading tusks, girdled with enamel, presents a firm ground of affinity with a still unknown primitive Lower Eocene proboscidean stem form. There the resemblance ends. These *Mærittheres* had no proboscis. The face, of brachyopic type, is markedly abbreviated. The cranium is elongated. Thus the facial and cranial proportions are analogous to those of the Sirenia. The upper grinding teeth are bilophodont, pointing to a tetrabunodont ancestry, and different from the bunomastodont grinders of *Palæomastodon*, which point to a hexabunodont ancestry. The lower grinders exhibit a rudimentary third crest. Andrews' opinion that the *Mærittheres* were amphibious is probably correct.

II.—Dinotherioidea

All agree that these animals were chiefly fluviatile and amphibious in habit, in this respect resembling *Mœritheres* but differing in the entire loss of the superior incisor teeth. Early loss of upper tusks released the inferior. In the downturning of the inferior tusks the *Dinotheres* are paralleled by the *Rhynchorostrinæ* among the *Mastodontoidea*. In skull

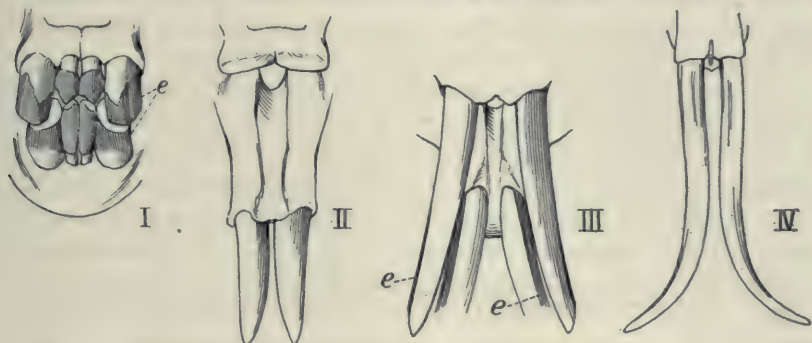


Fig. 1. Fundamental arrangement of the cutting teeth in the four superfamilies of the Proboscidea.

I.—*Mœritherium*. II.—*Dinotherium*. III.—*Rhynchotherium*. Composition of two species. IV.—*Stegodon*. *S. insignis* stage. Scale not uniform.

form and in limb and foot structure the *Dinotheres* parallel the true proboscideans. They diverge very widely from proboscideans in the evolution of the upper and lower grinding teeth. The primitive *Dinotheres* present simple bilophodont grinders, similar to those of *Mœritherium*, and are persistently bilophodont. The upper grinders attain a stage which parallels the molar pattern of the tapir (*Tapiroides*) among the perissodactyls, but shows no tendency to the trilophodont, tetralophodont, or polylophodont structure characteristic of the mastodons and elephants.

III.—Mastodontoidea

The fundamental character of the front teeth in this superfamily is seen in primitive members of the *Rhynchorostrinæ* and *Longirostrinæ*, namely:

Second superior incisors enlarged, downturned, divergent, with enamel band on the outer side only.

Second inferior incisors downturned (as in *Dinotheres*) with enamel band on outer side (*Rhynchorostrinæ*) or procumbent with no enamel band (*Longirostrinæ*).

The important functional distinction is that for a very long period of time the upper tusks abraded the outer side of the lower tusks; this probably explains the retention of the superior enamel band. In certain lines (Longirostrinæ) the procumbent lower incisors persist and the upper incisors retain their primitive downcurved position as in *Palæomastodon*. In other lines (Mastodontinæ, Brevirostrinæ) the lower incisors practically ceased to function; the upper incisors finally turn upward and inward, but may retain the enamel band for a long period (Mastodontinæ, *vide* Schlesinger, and Brevirostrinæ, *vide* *M. andium*).

A distinctive character of the grinding teeth of the Mastodontoidea is some evidence of the descent from a hexabunodont ancestral grinder (i. e., with intermediate tubercles or conules) as distinguished from the tetrabunodont ancestral type of *Mœritheres* and *Dinotheres*. The rudiments of ancestral conules gave rise to various trefoils or paired median outgrowths or crests, so characteristic of all the Bunomastodontidæ whether beak-jawed (Rhynchorostrinæ), or long-jawed (Longirostrinæ), or short-jawed (Brevirostrinæ). In each of these subfamilies the grinders independently undergo a more or less closely parallel evolution, evolving single trefoils in Upper Oligocene and in Miocene time, and double trefoils in Pliocene time.

Unlike the *Mœritheres* and *Dinotheres*, the three intermediate molars (i. e., fourth premolar and first and second true molars) invariably become trilophodont, while the third true molars become tetralophodont. At this point there is a divergence into (1) Mastodontidæ, purely forest living, brachyodont, with simply crested teeth, in which the intermediate molars are persistently trilophodont, with arrested trefoils, and into (2) Bunomastodontidæ, which pass into tetralophodonty and polylophodonty in some lines, with evolving trefoils. The grinder evolution is adapted to a leaf-browsing habit, in distinction to the prevailing grazing habit developed among the elephantoids. The development of hypsodonty, and chœrodonty (Schlesinger), among these (longirostrine and brevirostrine) browsers is analogous to that in the hippopotami and the hypsodont suillines.

IV.—Elephantoidea

One prime distinction in this superfamily is the very early complete loss of the lower incisor teeth, accompanied by the early development of the upper incisors into horizontal or upturned tusks finally devoid of enamel except at the tips in the young stage. Vestigial enamel bands are recorded in early stages of the stegodonts. A second distinctive

character is the absence of conule development into trefoils, so characteristic of the mastodontoids, and the early tendency to form evenly transverse, more or less mammillate, crests which become in the highest degree hypsodont and polylophodont in adaptation to chiefly grazing habits.

2.—EVOLUTION AND PHYLOGENY OF FAMILIES AND SUBFAMILIES

The phylogeny of species is now partly known; the Miocene phyla of Europe are being studied by Schlesinger. Systematic classification will follow a full understanding of the evolution and phylogeny. Forty-four generic names have been proposed for these animals and, as yet, an uncounted number of specific names. Generic and specific synonymy awaits (1) a clear separation of the phyla, (2) a determination of the precise geologic levels of types, and (3) a fuller knowledge of all the characters of the species. None of these data is complete as yet, hence the present contribution is preliminary to the author's revision of the synonymy.¹

We await also a restudy by Matsumoto of the characters of the *Mærittheres*, soon to be published in the American Museum Bulletin, also a fuller knowledge of the *Dinotheres* from unpublished materials in the British Museum. The positive determination of supposed south Asiatic relatives of *Mærittherium*, as well as of *Palæomastodon*, is very important. Pilgrim (1910, p. 67) provisionally refers to *Mærittherium* a small, primitive proboscidean molar from the Bugti Hills, Upper Oligocene. In the same beds occur *Hemimastodon crepusculi*, a longirostrine more recent in type than *Palæomastodon*. Ancestors of the Rhynchostrines and of the true Mastodontines should also be sought in southern Asia.

The Rhynchostrinæ

The type of this subfamily (*Rhynchotherium* Falconer, 1868) is a cast (observed in the Genoa Museum by Falconer) of a lower jaw from the Valley of Mexico; the jaw at the time had no specific or generic name. The original genotype may be termed *Rhynchotherium tlascalæ*, new species, from the locality Tlascala. A similar specimen from Mexico is in the American Museum (Fig. 2 C). The present known range of these animals is Mexico (*R. tlascalæ*), California (*R. shepardi* Leidy), Colorado (*R. brevidens* Cope), and Kansas (*R. euhypodon* Cope). It is note-

¹There is in preparation an iconographic revision of the known species of Proboscidea to be published in the American Museum Memoirs.

worthy that the Rynchorostrines are geologically the earliest forms of proboscideans known in America, i. e., *R. brevidens*, *R. proavus*. The

presence of a species of this subfamily in Middle Miocene beds was recently confirmed by Loomis.

The most distinctive feature of this phylum is the downturned of the symphysis, hence the name *Rhynchotherium*, or beak-jawed. A second distinction is the retention of the enamel bands on the lower tusks, to which the specific name *euhypodon* Cope (i. e., perfect lower teeth) refers. A third distinctive character is the relative simplicity and small size of the third grinders, hence the specific name *brevidens* Cope, applied to the most ancient form discovered in America. It would appear that the retention of effective upper and lower tusks relieved the grinding teeth in which the evolution is relatively slow. The known geologic succession of species is:

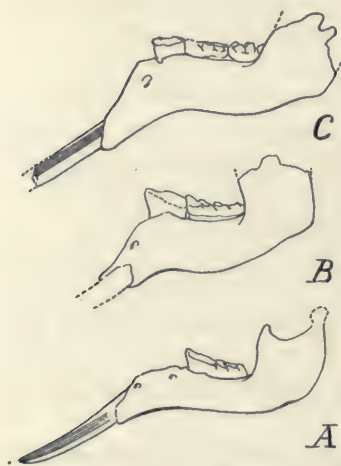


Fig. 2. Rhynchorostrine types of lower jaw.

A.—*Rhynchotherium euhypodon* Cope.
B.—*R. shepardi* Leidy. C.—*R. tlascalae*, new species. All figures $\frac{1}{4}$ natural size.

- | | | |
|-----------------------|---------------------------------------|---|
| <i>Rhynchotherium</i> | <i>tlascalae</i> , new species, 1921. | Valley of Mexico |
| " | <i>dinotherioides</i> Andrews, 1909. | N. W. Kansas. Pliocene |
| " | <i>euhypodon</i> Cope, 1884. | Lower Pliocene of Kansas |
| " | <i>shepardi</i> Leidy, 1871. | Stanislaus County, California. ?Miocene |
| " | <i>brevidens</i> Cope, 1889. | Middle Miocene, Deep River, Oregon |
| ? " | <i>proavus</i> Cope, 1873. | Middle Miocene, Pawnee Creek, Colorado |

The maxilla is partly downturned, as well as the mandibular symphysis. Both the superior and inferior incisors are laterally compressed, bending downward and outward. The grinding teeth remain relatively simple, brachyodont, with posterior grinders not exceeding four and a half crests. The intermediate grinders are trilophodont. The grinding series is reduced to $\frac{1}{2}$, $\frac{1}{4}$ as in *M. mirificus*.

The Longirostrinae

This is the most complete and ancient proboscidean phylum known. The four more or less complete skeletons of *T. angustidens*, *T. productus*, and *T. giganteus* prove that these were low-bodied animals, with ex-

tremely broad plevs and short heavy limbs. In the later phases of their evolution they were probably savanna- and stream-dwellers less closely confined to the forests than the Mastodontinæ. The extraordinary traveling powers of this family prove that they were well fed and well defended. The geologic and geographic range is indicated in the following partial list of species. There is an undoubted division of the family into three or four separate phyla, as follows:

I	II	III
Typical Longirostrines: Long, narrow inferior teeth; with typical tre- foils; Oligocene to Plio- cene. E. g., <i>T. angustidens</i> Cuvier and its successors.	Somewhat broader teeth; with typical trefoils; Miocene of Europe.	Without typical tre- foils; Miocene and Pliocene of America. E. g., <i>T. serridens</i> Cope.

Directly ancestral to phylum I appears to be *Palæomastodon wintoni* of the Fayûm Oligocene. The phyla I and II are still to be clearly distinguished in the Miocene of France. Phylum III first appears in the Upper Miocene of America but will probably be found in southern Asia as well as in France.

I. *T. ANGUSTIDENS* PHYLUM

PLIOCENE STAGES, double trefoils, intermediate molars four-crested.

Tetralophodon campester Cope, 1878. Republican River, Kansas.

" *longirostris* Kaup, 1835. Eppelsheim, Germany.

" *punjabiensis* Lydekker, 1886. Middle Siwaliks, India;
Dhok Pathan.

" *corrugatus* Pilgrim, 1913. Lower Pliocene, India.

MIocene AND LOWER PLIOCENE STAGES, intermediate molars three-
crested, single trefoils.

Trilophodon macrognathus Pilgrim, 1913. Middle Miocene, upper
Chinji, India.

" *giganteus*, new species, 1921. South Dakota.

" *floridanus* Leidy, 1886. Lower Pliocene, Florida.

" (*Megabelodon*) *hulli* Barbour, 1914. Snake River,
Nebraska.

" (*Tetabelodon*) *osborni* Barbour, 1916. Near Bristow,
Nebraska.

" (*Tetabelodon*) *willistoni* Barbour, 1913. Nebraska.

" (*Mastodon*) *obscurus* Leidy, 1869. Miocene, Maryland.

" (*Mastodon*) *productus*, Cope, 1874. Upper Miocene,
Clarendon, Texas.

" *angustidens palæindicus*. Manchhar, Middle Miocene,
India.

Trilophodon angustidens Cuvier. Type. Simorre, Middle Miocene, France.

" *pygmæus*. Lower Miocene, Africa.

UPPER OLIGOCENE, North Africa, India.

Hemimastodon (*Tetralodon*) *crepusculi* Pilgrim, 1912. Upper Oligocene. Bugti, Sind.

Palæomastodon wintoni Andrews, 1905. Upper Oligocene, Egypt.

III. *T. SERRIDENS* PHYLUM

Trilophodon (*Mastodon*) *serridens* Cope, 1884. Upper Miocene, Clarendon, Texas.

" (*Tetralodon*) *serridens cimarronis* Cope, 1893. Miocene, Clarendon, Texas.

" (*Dibelodon*) *præcursor* Cope, 1893. Blanco, Middle Pliocene, Texas.

? " *turicensis* Schinz. Middle Miocene, France.

In the typical Longirostrines (I) the lower jaws progressively elongate; rapidly attain great length in some of the European and American Miocene species, e. g., *T. lulli*, *T. giganteus*; relatively less elongate in the Pliocene species *Tetralophodon longirostris* and *T. campester*, as shown in the accompanying figure (Fig. 4). Throughout, the inferior incisors are without enamel band, spatulate, progressively flattened, horizontally appressed, more or less elongate; as the jaw swings abrading the dentine and inner side of the enamel bands of the superior tusks; the latter are rounded and slightly compressed, never oval as in *Rhynchotherium*. In *T. giganteus*, new species (Fig. 4 C), the two lower tusks turn toward each other.

A characteristic, of all the Miocene grinders observed, is the presence of a single trefoil invariably appearing first on the inner side of the upper teeth and on the outer side of the lower teeth. The double trefoils

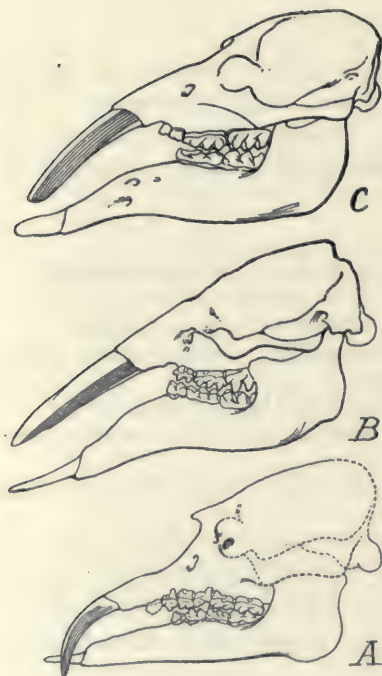


Fig. 3. Longirostrine types of jaw and skull.

A.—*Palæomastodon wintoni* Andrews.
B.—*Trilophodon serridens* Cope. C.—*Trilophodon productus* Cope. Scale not uniform.

(inner and outer) on the upper and lower grinders first appear in the uppermost Miocene and Lower Pliocene stages. The intermediate molars in all Miocene species observed are three-crested; hence these animals fall within the genus *Trilophodon* Falconer. The transition to the four-crested stage is observed in Upper Miocene types of Europe by Schlesinger. In all Pliocene species observed the intermediate molars are four-crested; hence they fall within the genus *Tetralophodon* Warren, Falconer. From the Middle Miocene apparently to the close of the Middle Pliocene there was a steady addition of crests to m_3 , rising from four and a half crests in the Middle Miocene (*T. angustidens*) to seven and a half crests in the Middle Pliocene (*T. barbouri*, new species). At the same time the crests become subhypsodont partly coated with cement.

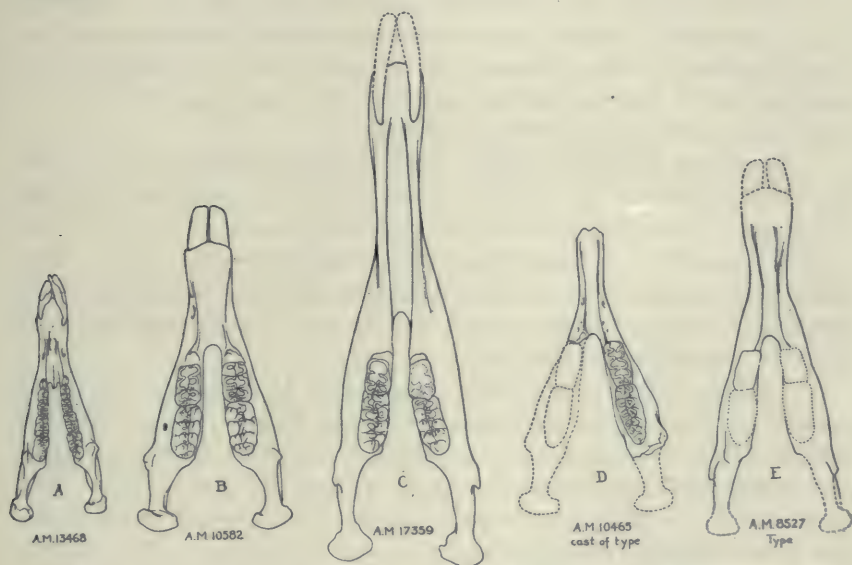


Fig. 4. Lower jaw and grinding teeth in the longirostrine phylum.

A.—*Palæomastodon wintoni* Andrews. Amer. Mus. No. 13468. B.—*Trilophodon productus* Cope. Amer. Mus. No. 10582. C.—*Trilophodon giganteus*, new species. Type, Amer. Mus. No. 17359. D.—*Tetralophodon longirostris* Kaup. Drawn after cast of type. Amer. Mus. No. 10465, Warren Collection. E.—*Tetralophodon campester* Cope. Type, Amer. Mus. No. 8527. All figures $\frac{1}{4}$ natural size. Grinding teeth in C, *Trilophodon giganteus*, foreshortened in drawing.

There is no evidence that any of the typical Longirostrines (I) were transformed into Brevirostrines by jaw-abbreviation. But it would appear that from certain atypical long-jawed forms (perhaps from phylum II of France with broader molar teeth) arose the *Eubelodon morrilli* type of Barbour, to be described below, without lower tusks, of the Lower Pliocene, Devil's Gulch, Nebraska.

TWO NEW SPECIFIC STAGES.—A new specific stage more recent in character than *T. floridanus* Leidy appears to be represented in the skeleton and jaws (Amer. Mus. No. 17359) discovered in South Dakota by E. L. Troxell in 1916, to which the name **Trilophodon giganteus**, new species, may be applied. It exhibits rudiments of double trefoils and the lower incisors are upturned at the sides so as to face partly inward (Fig. 4 C). A second new species is the **Tetralophodon barbouri**, of which the type (Neb. State Mus. No. 4.22.6.16) is a grinding tooth with double trefoils, seven and a half to eight crests, and cement; thus advanced much beyond *T. campester* with six and a half crests on the superior grinders, without cement.

The Brevirostrines of South America

It now appears that the South American Brevirostrines, *M. andium* and *M. humboldtii*, were not derived directly from the Eurasiatic Brevirostrines, typified by the Eurasiatic *M. arvernensis* and *M. sivalensis*, nor were the South American forms descended from the *M. mirificus* Leidy, which appears to be an Eurasiatic migrant.

The reason for this opinion is that the molar pattern of *M. andium* and *M. humboldtii* is of simple bunomastodont type, with single trefoils (*M. andium*) and double trefoils (*M. humboldtii*), a type familiar in the typical American Longirostrines and Rhynchorostrines only. The Eurasiatic Brevirostrines and the American *M. mirificus*, on the other hand, have molar grinding teeth which Schlesinger aptly terms *chaerodont* (pig-like, covered with tubercles).

Another typical longirostrine character in *M. andium* is the broad enamel band on the superior tusks. It is not known in any European Brevirostrine. Consequently, it appears probable that the South American bunomastodonts independently abbreviated the jaw and that they may possibly be related to the only American form known in which the jaw is abbreviated, namely, *Eubelodon morrilli* Barbour. The phylum thus appears to be as follows:

Mastodon humboldtii Cuvier. Lower Pliocene

" *andium* Cuvier. Upper Pliocene. Andean region

" (*Dibelodon*) *tropicus* Cope, 1884. Valley of Mexico

" *successor* Cope, 1892. Blanco, Middle Pliocene, Texas

?*Eubelodon morrilli* Barbour, 1913. Devil's Gulch, Lower Pliocene, Nebraska

Eubelodon morrilli exhibits an abbreviated lower jaw, no lower tusks, superior* tusks without enamel band (Barbour, 1920). Thus it differs from *M. andium* in one important character, namely, in the absence of the enamel band.

The Brevirostrines of Eurasia and North America

Suddenly in the Lower Pliocene of the Siwaliks, India, appears *M. hasnoti* Pilgrim, in the Dhok Pathan horizon, stage of Pikermi, of Eppelsheim. According to Pilgrim this differs from the true *M. sivalensis* Falconer of the Middle Pliocene, Tatrot horizon, in having $m\frac{2}{2}$ tetralophodont and in the slightly marked alternation of the cones. The Middle Pliocene *M. sivalensis* has a pentalophodont $m\frac{2}{2}$ and the cones are more alternate. The closely related Brevirostrine (*M. arvernensis*) of southern Europe ranges from the lignites of Casino (Middle Pliocene) to the First Interglacial stage in England (Crag). Similarly, the *M. mirificus* of Leidy was first described in association with *Elephas imperator* and determined by Hay as of the Aftonian, i. e., First Interglacial stage. The known succession of described forms in these browsing, forest-living elephants of the warm zones is as follows:

- Mastodon arvernensis*. Norwich fluviomarine crag, Norfolk, England
- " *arvernensis* Croizet et Jobert. Typical. Upper Pliocene of Auvergne
- " *mirificus* Leidy. Typical of *E. imperator-Equus* zone of Nebraska
- " *chapmani* Hays, 1834. Geologic level unrecorded
- " *sivalensis* Falconer. Tatrot horizon, Middle Pliocene, Siwaliks, India
- " *brevirostris* Gervais, 1846. France
- " *pentelici* Wagner. Pikermi, Lower Pliocene, Greece
- " *hasnoti* Pilgrim. Dhok Pathan horizon, Lower Pliocene, India

The unique feature of the members of this phylum is the alternation of the inner and outer cones of the grinding teeth, which are placed obliquely instead of opposite each other. A further distinctive character is the brevirostral, brachycephalic skull, which parallels that in all the Elephantoida. The jaws rapidly abbreviate and lose the lower tusks in an early stage. The upper tusks, at first elongate and horizontal (*M. arvernensis*), are upturned and out-turned (*M. mirificus*). No enamel band has been observed. The grinding action of the teeth, like that of the pigs, peccaries, and hippopotami, explains the early evolution of double trefoils and finally of accessory tubercles; hence the apt term choerodont, applied by Schlesinger. The intermediate grinders, at first trilophodont, become tetralophodont (*M. hasnoti*), pentalophodont (*M. sivalensis*). The posterior grinders $m\frac{3}{3}$ evolve six and a half crests (*M. arvernensis*), the cones becoming subhyposodont.

Within the Brevirostrinae are at least two phyla: I. *Mastodon arvernensis*, termed *Dibunodon* by Schlesinger; and II. *Mastodon pentelici*, termed *Charolophodon* by Schlesinger, with a longer symphysis, represented in Samos and in Maragha, Persia. III. To a third

phylum may belong *M. hasnoti*, *M. sivalensis*, India (see Schlesinger,¹ pp. 224-229), *M. mirificus*, North America.

The Mastodontinæ

Forest-living animals are rarely found fossil, e.g., the forest-living Chalicotheres of the entire Tertiary. The massive, low-bodied, low-headed, well-defended Mastodontinæ probably evolved chiefly in the north temperate forests of Eurasia. That they were cold-loving animals is shown by their avoidance of southern Eurasia, except for the single appearance of *M. borsoni* in the Upper Pliocene of the Val d'Arno in northern Italy. Of one of the oldest known forms (*M. tapiroides* Cuvier) of the Middle Miocene of France, according to Schlesinger, occasional descendants are found in Europe. All are zygalophodont; the cones of the grinders turning into transverse crests, the intermediate conules remaining rudimentary, no trefoils forming. Superior incisors (Miocene) retain enamel bands (Schlesinger), but, released from apposition with the lower incisors, turn upward and outward; the lower incisors persisting as abbreviated, horizontal, rounded tusks. The jaws and skull abbreviated, brachycephalic. Intermediate grinders persistently trilophodont. Posterior grinders progressing to a tetralophodont stage only. The vertical chopping motion of the jaws, as distinguished from the grinding motion in the Longirostrines and the Brevirostrines, explains the retention of simple crests and the non-development of trefoils and tubercles.

All ancestral stages will doubtless be found in northern Eurasia. The *M. borsoni* of the Upper Pliocene forests extends into Russia and is directly or indirectly ancestral to the *M. americanus*, a Pleistocene arrival in North America. The chief known specific stages are:

Mastodon americanus. Pleistocene

- " *progenium* Hay. Missouri Valley, Iowa
- " *borsoni* Hays. Upper Pliocene, Val d'Arno, Italy
- ? " *turicensis (tapiroides)*. Middle Miocene, Simorre, France
- ? " *pyrenaicus*. Middle Miocene, France
- " *tapiroides* Cuvier. Middle Miocene, France

These six outstanding species are doubtfully placed in one phylum awaiting further evidence.

The Stegodontinæ of Southern Eurasia

We observe that the Stegodonts are persistent browsers, probably tropical, forest-living proboscideans. According to Pohlig, from the

¹1917, Denksch. K. K. Naturhist. Hofmuseums, I, Geol.-Paläontol., Rheide 1, pp. 1-230.

skeleton discovered in Trinil, Java, they have short, massive bodies like those of the Mastodontinæ of the north temperate forests. The skull and tusks do not lead into either the Elephantinæ or the Mammontinæ types. The phyletic succession of species is clarified by Pilgrim's geologic subdivisions of the Siwaliks and by his observations on the succession of specific types, which provisionally may be arranged as follows:

- Stegodon ganesa* (male), *S. insignis* (female). Upper Pliocene and Lower Pleistocene, southeastern Eurasia
 " *stegodontoides* Pilgrim, 1913. Lehi, Upper Siwaliks. ?Middle Pliocene
 " *cliftii* Falconer. Dhok Pathan horizon, Lower Pliocene, India
 " *bombifrons* Falconer. Dhok Pathan, India
 " *cautleyi* Lydekker. Perim Island. Upper Miocene
 " *latidens* Clift. Irawadi River, Asia

The distinctive feature of the grinding teeth is the rapid multiplication of transverse crests which rise from the formula 4.5.6.6.7-8 in *S. cliftii* (Lower Pliocene) to 5.9.10.12.13 in *S. insignis* (Lower Pleistocene). Jaw rapidly abbreviated. Upper tusks straight, parallel, slightly up-curved (adapted to dense forests). Grinders brachyodont to subhypso-dont, crests breaking up into small mammillæ, valleys filling with cement.

The Loxodontinæ

The late appearance (Upper Pliocene) of these Loxodonts in Italy, the dwarfed evolution in all the Mediterranean islands, the still later geologic appearance (Lower Pleistocene) in Asia, and the existing exclusive occupation of Africa by a great variety of Loxodonts, point to Africa as the original center of adaptive radiation of the Loxodontinæ. This phylum is abundant in the Pleistocene of northern Africa, e.g., *L. atlanticus*.

There is, on the other hand, no trace of these animals in the Pliocene Siwaliks of India; Pilgrim records the first occurrence of *L. antiquus namadicus* in the Lower Pleistocene of Godáviri and Narbada, which also contains *Stegodon ganesa* and *S. insignis*.

The gigantic, wide-spreading upper incisors implanted in the maxillo-premaxillary rostrum are quite distinct from those of either the Stegodontinæ, Mammontinæ, or Elephantinæ. The height attained at the shoulder (*L. namadicus*) is estimated at sixteen feet (Pilgrim), five feet taller than the existing *L. africanus*. The affinity of *L. namadicus* to *L. antiquus* (Upper Pliocene to Middle Pleistocene, Europe) and to *L. africanus* has been pointed out by Falconer, Leith Adams, Pohlig, and Pilgrim. Within the subfamily Loxodontinæ there are a great number

and variety of species undoubtedly belonging to more than two phyla, namely:

- | | |
|------------------------------|--|
| <i>Loxodonta africanus</i> . | Recent, Africa, including fifteen species and subspecies |
| “ <i>antiquus</i> . | Upper Pliocene to Middle Pleistocene, Europe |
| “ <i>namadicus</i> . | Lower Pleistocene, India and southern Eurasia |
| “ <i>creticus</i> | } Mediterranean Islands |
| “ <i>melitensis</i> | |
| “ <i>mnaidriensis</i> | |
| “ <i>atlanticus</i> . | Pleistocene of northern Africa |

Another fossil member of this race has recently been recorded in German West Africa.

The Mammontinæ. The Mammoths

It is a striking fact that the oldest geologic appearance of a member of the true Elephantoidæ is the *Elephas planifrons* occurring in the Pinjor horizon, Upper Siwaliks, Middle to Upper Pliocene, India. All the fauna of the great Siwalik deposits underlying this geologic level, according to Pilgrim, contain only Stegodonts, Longirostrines, and Brevirostrines. This is significant of a north Eurasiatic center of adaptive radiation of both the Mammontinæ and the Elephantinæ. The chief distinction between these two subfamilies lies in the flattened forehead of the Mammoths, to which the specific name *planifrons* refers, a forehead which becomes increasingly concave and compressed antero-posteriorly until it reaches the high, narrow peak of *E. imperator*.

Again, the succession of species is probably polyphyletic, awaiting analysis. In descending order the main geologic succession is as follows:

- | | | |
|----------------------------|-------------------|--|
| <i>Elephas primigenius</i> | Blumenbach. | Northern Eurasia and North America, |
| | Upper Pleistocene | |
| “ <i>columbi</i> | Falconer. | Middle Pleistocene, North America |
| “ <i>imperator</i> | Leidy. | Lower Pleistocene, North America |
| “ <i>trogontherii</i> | Pohlig. | Lower Pleistocene, Europe |
| “ <i>hysudricus</i> | Falconer. | Uppermost Pliocene, India |
| “ <i>meridionalis</i> | Nesti. | Upper Pliocene, Val d'Arno, Italy |
| “ <i>planifrons</i> | Falconer. | Pinjor horizon, Middle to Upper Pliocene, India, |
| | | also Austria and Bessarabia (Russia) |

The position of *E. hysudricus* in this phylum is doubtful. The cranium referred to this species by Falconer is not of the mammontine type. In 1913 Pilgrim traced back *E. planifrons* to the Upper Miocene *Stegodon cautleyi*, but it would appear at present that none of the known Stegodonts gave rise to the Mammoths. Extreme cranial abbreviation,

hyperbrachycephaly, and acrocephaly are great characteristics of all the phyla in this subfamily (excepting possibly that to which *E. hysudricus* belongs). There is a wide range of divergence in the thickness and multiplication of the lamellæ of the grinders. *Elephas imperator* may be derived from the *E. meridionalis* type, with very few lamellæ, composed of thick enamel bands and with a great coating of cement, or from the *E. planifrons* Falconer type. The *E. primigenius* phylum presents the highest lamellar formula known, with relatively little cement; this phylum is also distinguished by the loss of a digit in the pes, becoming tetradactyl, a unique character among proboscideans. Very great shoulder height, estimated at thirteen feet, is attained by *E. imperator* in the favorable environment of the southern United States and Mexico, as compared with the height of nine feet six inches attained by *E. primigenius* in the frigid north.

istocene

The Elephantinæ

Like the Mammoths, these animals suddenly appear in the Upper ~~Pliocene~~ of India. They are not found in the Lower Pleistocene, where their place in the fauna is taken by the invading loxodont, *L. namadicus*. In distinction from the Mammoths, the forehead is prominent, convex, in adults highly convex. The upper tusks extend forward and outward, slightly upcurved, not crossing each other in old age as in the more recent Mammoths *E. primigenius* and *E. imperator*. Unlike *E. primigenius*, five digits persist on the fore and hind feet. Skull brachycephalic. Jaws abbreviated. Vestigial lower incisors, enamel remaining on the tips only in young stages. Mammillæ more numerous than in the Loxodonts; less numerous than in *E. primigenius*.

The Unknown Home of the Elephantoidæ

It appears from the above preliminary studies that the proboscidean phylogeny is still subject to many emendations, transpositions, and corrections. It is in the rocks of the great unexplored regions of Eurasia and of Africa—nearly a hundred-fold greater than the regions explored and known—that we must look for the ancestry of the four great branches of the Elephantoidæ, namely, the Stegodonts, the Loxodonts, the Mammoths, and the true Indian elephant type.

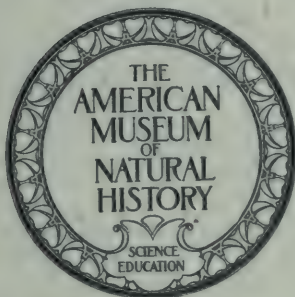
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DESCRIPTIONS OF APPARENTLY NEW BIRDS FROM BOLIVIA, BRAZIL, AND VENEZUELA

By FRANK M. CHAPMAN



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DESCRIPTIONS OF APPARENTLY NEW BIRDS FROM BOLIVIA, BRAZIL, AND VENEZUELA

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The material on which this paper is based is contained in the American Museum and in a small collection recently submitted to us for determination by Dr. Emilia Snethlage of the Museu Goeldi at Pará.

The color terms employed are those of Ridgway's 'Color Standards and Color Nomenclature' (Washington, 1912).

Capito brunneipectus, new species

SPECIFIC CHARACTERS.—Upperparts resembling those of *Capito auratus auratus*, but male with the throat pale cinnamon-buff, breast ochraceous tawny, abdomen light yellowish olive widely margined with greenish yellow; no wing-bars. Female with the throat and breast richer, the former spotted with black, the greater wing-coverts, except terminally, externally margined with old gold.

TYPE.—No. 13709, Museu Goeldi, ♂ ad., June 16, 1917, Villa Braga, Rio Tapajoz, Brazil; Emilia Snethlage.

DESCRIPTION OF MALE.—Entire crown shining old gold, browner on the forehead, yellower on the nape; cheeks, sides of the nape, and back black; interscapulars widely margined with lemon-yellow forming two lines from the nape to the lower back, the latter and rump margined with greenish yellow; tail olivaceous, nearly uniform; wings fuscous, all but the outer quills externally margined with dark citrine, the larger part of the outer web of the tertials olive-buff; lesser and median coverts shining blue-black like the back; greater and primary coverts duller; lower coverts and inner margins of quills buffy; throat and sides of the neck pale cinnamon-buff unmarked; breast-band deep buckthorn-brown narrowly tipped with greenish yellow; feathers of the rest of the underparts broadly tipped with greenish yellow not wholly concealing their olivaceous bases, tibiae with less yellow, ventral region whiter; lower tail-coverts olive tipped with whitish; feet plumbeous; bill black, a horn-colored band at the base of the mandible. Wing, 81.5; tail, 48; tarsus, 22.5; culmen, 21.5 mm.

DESCRIPTION OF FEMALE.—Similar to the male but with the margins of the interscapulars duller, the interseapulum and lesser wing-coverts more or less yellow margined; the greater coverts externally olive-citrine, except at the tip; the throat and sides of the neck with numerous round black spots forming a narrow malar streak, the breast-band deeper, argus-brown; the abdominal region somewhat more olivaceous. Wing, 79-82; tail, 50-54; tarsus, 21-21.5; culmen, 20.5-21.5 mm. (3 specimens).

SPECIMENS EXAMINED.—*Capito brunneipectus*. Brazil: type locality, 1 ♂, 3 ♀♀. *Capito auratus auratus*. Colombia: Buena Vista, 2 ♂♂, 5 ♀♀.

The discovery of this bird not only adds a very distinct species to the genus *Capito* but extends the known range of the genus into the southern part of lower Amazonia. It also gives further emphasis to the apparently restricted areas occupied by certain strongly marked species of this group. Thus *Capito squamatus* is known only from western Ecuador and southwestern Colombia; *C. quinticolor* from western Colombia; *C. hypoleucus* from the Cauca-Magdalena Fauna of Colombia; *C. dayi* from Porto Velho on the Rio Madeira; and *C. brunneipectus* from Villa Braga on the Rio Tapajoz.

In view of the antiquity of the genus to which they belong, can it be possible that the restricted ranges of these birds indicates that they are disappearing species?

***Nonnula amaurocephala*, new species**

SPECIFIC CHARACTERS.—Most nearly related to *Nonnula ruficapilla* (Tsch.), but sides of the head and neck, as well as crown, deep burnt sienna.

TYPE.—No. 12490, Museu Goeldi, ♂ ad., July 18, 1916, Manacapurú, Rio Solimões, Brazil; F. Lima.

DESCRIPTION OF MALE.—Entire head, including nape, lores, eye-ring, auriculars, and sides of the neck rather deep burnt sienna, becoming light Sanford's brown on the underparts and ochraceous buff on the flanks; the lower abdomen, ventral region and under tail-coverts white; back dull, Brussels-brown; remiges basally the color of the back, blacker apically except on the outer feathers which are uniform; wing-quills like rectrices, the inner quills lightly margined with buckthorn-brown; greater, median and lesser wing-coverts like the back; bend of the wing ochraceous orange; lining of the wing ochraceous buff; feet blackish brown; bill black, the mandible yellowish except at the tip and sides. Wing, 61; tail, 52; tarsus, 14; culmen (broken).

DESCRIPTION OF FEMALE.—Similar to the male but underparts somewhat paler. Wing, 63; tail, 55.5; tarsus, 14; culmen, 25 mm.

SPECIMENS EXAMINED.—*Nonnula amaurocephala*. Brazil: type locality, 1 ♂, 1 ♀.

Nonnula ruficapilla, Plate XLVI, fig. 1, Selater, 'Monograph of the Jacamars and Puffbirds.'

While this form may represent *N. ruficapilla*, it appears to differ specifically from that bird, in which the sides of the head and neck are gray.

***Rhopochares cochabambæ*, new species**

SPECIFIC CHARACTERS.—In size and general coloration nearest *Rhopochares ruficapillus* (Vieill.), but back grayish sharply defined from crown, as in *Rhopochares torquatus* (Swains.).

TYPE.—No. 139234, Amer. Mus. Nat. Hist., ♂ ad., Tujima, alt. 8200 ft., Prov. Cochabamba, Bolivia, September 25, 1915; Miller and Boyle.

DESCRIPTION OF MALE.—Crown between auburn and burnt sienna, forming a distinct cap; lores and frontal region (less clearly) buffy; auriculars gray or grayish white; postorbital region and sides of the nape pale smoke-gray, becoming deeper gray on the back and rump, where more or less washed or mixed with cinnamon-rufous; all the tail-feathers, including the central pair, blackish; the central pair more or less margined externally with grayish, in some cases slightly margined or indented with white, usually on the inner web; remaining feathers tipped with white and with white bars on the inner web, not reaching the shaft, the outer feathers usually indented with white on the outer web; wings externally ochraceous tawny, lined with light ochraceous buff; underparts whitish, the throat, ventral region and flanks washed with buffy, the breast barred with black as sharply but less extensively than in *Rhopochares ruficapilla*. Wing, 68–70; tail, 73–75; tarsus, 25–27; culmen, 15–16 mm.

DESCRIPTION OF FEMALE.—Crown cap as in the male, the back averaging more cinnamon-rufous than in the male; tail like the crown, the feathers with paler tips and indistinct blackish bands terminally; underparts much paler than in *R. ruficapilla*, buffy white, without black bars. Wing, 64–69; tail, 67–68; tarsus, 26–28; culmen, 14.5–15.5 mm.

SPECIMENS EXAMINED.—*Rhopochares cochabambæ*. Bolivia: type locality, 7 ♂♂, 7 ♀♀; Valle Grande, 7200 ft., 1 ♀. Argentina: Perico, 4000 ft., Prov. Jujuy, 1 ♂.

Rhopochares ruficapilla. Argentina: Buenos Aires, 2 ♂♂; La Plata, 1 ♀. Uruguay: Concepcion, 1 ♂. Brazil: Rio Grande do Sul, 1 ♂; Ypanema (Natterer), 1 ♂.

This species combines in an interesting way the color characters of *R. ruficapilla* and *R. torquata* and, while evidently representing the former, is, in my opinion, specifically distinct. It ranges at least from the Province of Cochabamba, Bolivia, southward to the Province of Jujuy, Argentina, whence we have a male which, aside from having the black breast-bars somewhat wider, agrees with our topotypical series.

Possibly specimens recorded from Tucuman and Salta¹ as *Thamophilus ruficapillus* should be referred to the species here described.

***Microrhopias emiliæ*, new species**

SPECIFIC CHARACTERS.—Male similar in color to male of *Microrhopias boucardi virgata* but larger, female with the throat and breast chestnut, the belly black.

TYPE.—No. 10775, Museu Goeldi, ♀ ad., May 28, 1914, Alta Mira, Rio Xingu, Brazil; Emilia Snethlage.

DESCRIPTION OF MALE.—Rich velvety black; remiges and rectrices somewhat duller, interscapulars snowy white basally, this color not wholly concealed by their black tips; greater wing-coverts broadly tipped with white, median coverts with rounded white terminal spots, lesser coverts and wing "lining" white; all but median

¹Dabbene, 1910, *Anales Museo Nacional*, Buenos Aires, (3) XI, p. 284.

rectrices with white tips 7-8 mm. in length on outer feathers, decreasing abruptly to 2 mm. on inner pair; feet grayish black; bill black. Wing, 55-56; tail, 52-53; tarsus, 16.5; culmen, 14.5-15 mm. (2 specimens).

DESCRIPTION OF FEMALE.—Similar to the male but slightly duller, particularly on the abdomen, the throat and breast deep, rich chestnut. Wing, 53-54; tail, 51-52; tarsus, 16-17; culmen, 15 mm.

SPECIMENS EXAMINED.—*Microrhophias emiliae*. Brazil: type locality, 1 ♂, 1 ♀; Rio Tocantins, 1 ♂, 1 ♀.

Microrhophias boucardi virgata. Panama, a large series.

Microrhophias boucardi consobrina. Ecuador and Colombia, a large series.

Microrhophias boucardi bicolor. Brazil: Rio Tapajoz, 1 ♂, 1 ♀; Rio Roosevelt, 1 ♂; Porto Velho, 1 ♂, 1 ♀; Baron Melgaco, 2 ♀ ♀.

Microrhophias quixensis. Ecuador, 1 ♀.

It seems unusually appropriate to name this new species, in which the characters are shown only by the female, after its discoverer Dr. Emilia Snethlage, whose energy in the field and zeal in the study have added so greatly to our knowledge of the birds of Amazonia.

***Drymophila devillei subochraceus*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Drymophila devillei devillei* Men. and Hellm., but both sexes with entire underparts ochraceous buff, paler on the throat and center of the abdomen, deeper on the breast and flanks; outer margins of inner wing-quills more ochraceous; female with ochraceous streaking of the upperparts and of wing-coverts somewhat deeper.

TYPE.—No. 10777, Museu Goeldi, ♂ ad., November 7, 1914, Rio Curuá (a tributary of the lower Xingu), Brazil; Emilia Snethlage.

SPECIMENS EXAMINED.—*Drymophila devillei subochraceus*. Brazil: type locality, 1 ♂, 1 ♀.

Drymophila devillei devillei. Bolivia: Jatumpampa, 1 ♂ (type of *Drymophila phantatis* Cherrie); Mission San Antonio, Rio Chimoré, 4 ♂ ♂, 3 ♀ ♀.

It is interesting to observe that in this form the male and female are essentially alike below, the former having the breast buff instead of white, as in its allies true *devillei* and *caudata*. The female of *caudata caudata* nearly resembles *subochraceus* in the ground-color of the underparts, but is somewhat paler and slightly yellower. The female of *caudata klagesi*, on the contrary (if our two specimens properly represent it), has the breast white as in the male. In coloration of the underparts *klagesi* closely approaches true *devillei* from which it is distinguished chiefly by the lack of white markings on the sides of the central rectrices.

Drymophila phantatis Cherrie is apparently not separable from *devillei devillei* Men. and Hellm.

Hypocnemis hypoxantha ochraceiventris, new subspecies

SUBSPECIFIC CHARACTERS.—Similar to *Hypocnemis hypoxantha hypoxantha* ScL., but somewhat larger, with a larger bill the color throughout browner, the underparts paler yellow, the breast more streaked, the flanks and lower tail-coverts pale ochraceous buff, the abdomen slightly washed with this color; wing-coverts, in the female, tipped with warm buff. Male: wing, 55; tail, 46; tarsus, 20; culmen, 14 mm. Female: wing, 53.5; tail, 44; tarsus, 19.5; culmen, 14 mm.

TYPE.—No. 10788, Museu Goeldi, ♂ ad., May 28, 1914, Alto Mira, Rio Xingu, Brazil; Emilia Snethlage.

SPECIMENS EXAMINED.—*Hypocnemis hypoxantha ochraceiventris*. Brazil: type locality, 1 ♂, 1 ♀.

Hypocnemis hypoxantha hypoxantha. Colombia: La Morelia, 1 ♀. Brazil: Upper Amazon, Pl. XLIII, P. Z. S., 1868, ♂ ad.

Hypocnemis flavescens subflava. Peru: Perené, 1 ♂, 1 ♀; Rio Javara, 1 ♂, 1 ♀; La Pampa, 1 ♂. Bolivia: Todos Santos, 7 ♂♂, 3 ♀♀.

In the coloration of the underparts this species is essentially like *H. f. subflava*. It is, however, separated from that species and from *H. f. flavescens* by its yellow instead of white superciliary and more olive, less striped upperparts.

The form from Bolivia and Peru (*subflava*) is evidently a southern race of *flavescens*, but the specific distinctness of *hypoxantha* is indicated by its occurrence in the heart of the range of *flavescens*.

Hypocnemis collinsi Cherrie proves to be inseparable from *H. f. subflava* Cab.

Siptornis punensis cuchacanchæ, new subspecies

SUBSPECIFIC CHARACTERS.—Similar to *Siptornis punensis punensis* Berl. and Stolz., but upperparts more distinctly streaked; underparts, particularly ventral region and lower tail-coverts paler; rufous markings of wing decidedly lighter; tail longer. Resembling *Siptornis punensis lilloi* Oust., but general tone of the upperparts less rufescent, margins of tertials and greater wing-coverts paler, sayal-brown rather than cinnamon-rufous; rufous band in wing-quills paler and less extensive, particularly on outer quills.

TYPE.—No. 137292, Amer. Mus. Nat. Hist., ♂ ad., Cuchacancha, Bolivia, June 13, 1915; Miller and Boyle.

SPECIMENS EXAMINED.—*Siptornis punensis cuchacanchæ*. Bolivia: type locality, 9 ♂♂ ads., 1 ♀ ad.

Siptornis punensis punensis. Bolivia: Guaqui, 1 ♂ ad., 1 ♀.

Siptornis punensis lilloi. Argentina: Above Tafi del Valle, alt., 9500 ft., 3 ♂♂ ads. (including type of *Siptornis punensis rufala* Chapman), 1 ♀ ad., 4 ♂♂ imm., 2 ♀♀ imm.

Siptornis punensis punensis was described from Puno, Peru, on the northwest shore of Lake Titicaca. It is probable, therefore, that two specimens from Guaqui, distant 115 miles, on the southern shore of the

lake, recently presented to the museum by Lord William Percy, are essentially typical of that form.

They show that specimens from Cuchacancha near Cochabamba, which, in default of topotypical material I had referred to *punensis punensis*,¹ are separable from that race as well as from the Argentine race.

The latter I described as *Siptornis punensis rufala* (*loc. cit.*), but Dr. Hellmayr assures me that this bird is the same as *Siptornis lilloi* Oust., an opinion which may be accepted as authoritative, though as stated in describing *rufala* I am unable to make Oustalet's description conform with our Argentine specimens.

Measurements

	WING	TAIL	CULMEN
Cuchacancha, ² Prov. Coch., Bolivia, ♂	76	94	13.5
Cuchacancha, ² Prov. Coch., Bolivia, ♂	78	97.5	14.5
Cuchacancha, ² Prov. Coch., Bolivia, ♂	73	93.5	14
Cuchacancha, ² Prov. Coch., Bolivia, ♂	75	94	13.5
Guaqui, ³ Bolivia, ♂	78	88	13
Cuchacancha, ² Prov. Coch., Bolivia, ♀	71	89.5	13
Guaqui, ³ Bolivia, ♀	69	87.5	13.3

Cistothorus platensis caracasensis, new subspecies

SUBSPECIFIC CHARACTERS.—Similar in general tone of color to *Cistothorus meridae* Hellm., but somewhat less rufescent, the crown being uniform in color and olive-brown rather than Prout's brown; differing also in size, proportions and pattern, the tail being longer and equal to the wing, the tarsi and bill shorter, the latter proportionately more decurved; the rump unbarred, the scapulars less striped, the wing-coverts less definitely barred, the bars of the median rectrices broken, the flanks faintly, if at all, barred, the superciliary barely evident. In general pattern of coloration much nearer to *Cistothorus platensis æquatorialis* Lawr., but much less rufescent, the central tail-feathers not regularly barred, the wing, tarsi and bill shorter, the tail nearly as long, and therefore proportionately longer. Male: wing, 44.5; tail, 43.5; tarsus, 16; culmen, 11.5 mm.

TYPE.—No. 150 610, Amer. Mus. Nat. Hist., ♂ ad., Cotiza, Caracas, Venezuela; August 22, 1918; George K. Cherrie.

SPECIMENS EXAMINED.—*Cistothorus platensis caracasensis*. Venezuela: type locality, 2 ♂ ♂; ? Escorial, near Mérida, 1 ♂.

Cistothorus meridae. Venezuela: Sierra Nevada, Mérida, alt. 3000 m., 1 ♂; Conejos, near Mérida, 3000 m., 1 ♂.

¹1919, Bull. Amer. Mus. Nat. Hist., p. 329.

²*Siptornis punensis cuchacancha*.

³*Siptornis punensis punensis*.

Cistothorus platensis æquatorialis. Ecuador: Pichincha (type locality), 1 ♂; Mt. Chimborazo, 3 ♂ ♂. Colombia: Valle de las Pappas, Cen. Andes, 1 ♂, 1 ♀; Santa Isabel, Cen. Andes, 3 ♂ ♂, 5 ♀ ♀; Chipaque, near Bogotá, 1 ♂; Choachí, near Bogotá, 4.

Cistothorus apolinari. Colombia: Suba Marshes, Bogotá (type locality), 9.

Mr. Cherrie's discovery of a Marsh Wren in a region so well known as the vicinity of Caracas, extends the known range of this group eastward from Mérida (a distance of some 300 miles) and, incidentally, is evidence of his skill and energy as a collector.

The Caracas race is the least rufescent of any of the described forms of the group, and in general tone of coloration closely approaches *Telmatodytes palustris marianæ* (Scott) of the southeastern United States.

I have seen neither *Cistothorus platensis tamæ* Cory, from the Páramo of Tamá, on the Venezuelan-Colombian boundary, nor *Cistothorus æquatorialis fulvescens* Todd, from the Páramo of Guerrero, Santander, Colombia. The first is described as being "more rufous brown," the second as "more rufescent" than *æquatorialis* and presumably, therefore, they both differ more from *caracasensis* than does *æquatorialis*. Todd (1919) makes no mention of Cory's (1916) race and, since both birds are from the same general region and appear to differ from *æquatorialis* in much the same manner, their comparison is to be desired.

The study of our material discloses the interesting fact that, as at Bogotá, two forms of this Wren are found in the Mérida region. The first, described by Hellmayr as *Cistothorus platensis meridæ*, is, in my opinion, unquestionably a distinct species distinguished from *æquatorialis* by its short tail (35 mm.), long hind-toe (19 mm.), pronounced white superciliaries, barred wing-coverts, rump, flanks, etc., as more fully noted in the diagnosis of *caracasensis*. The second, of which we have only one specimen, obviously represents the Caracas race with which it agrees exactly in size and very nearly in color, but has the back more broadly barred with white, the bars on the central tail-feathers complete, as in *æquatorialis*. If these differences are constant they are clearly of subspecific value.

In describing this proposed new race as a subspecies of *platensis*, I merely follow a convention. As a matter of fact, I have no specimens of *platensis* and it is possible that the Andean forms of the *æquatorialis* group may not intergrade with the form of the South Temperate Zone. The known facts in the variation of the Andean races are, however, too contradictory in character to be of predicated value. Thus, true *æquatorialis* ranges from at least Chimborazo to Bogotá, a distance of

some 600 miles, without exhibiting racial variations; but in passing from the Páramo of Choachí to the Savanna of Bogotá, a distance of 20 miles, we go from the range of *æquatorialis* to that of the specifically distinct, but representative, *C. apolinari*. Furthermore, two forms, which I consider as also specifically distinct, are here shown to inhabit the Mérida region. It is obviously, therefore, not always safe to assume that what we believe to be representative forms are also intergrading races.

Measurements¹

	Wing	Tail	Tarsus	Hind-toe and Claw	Culmen
Chimborazo, ² Ecuador	48	44	20	13	12
Pichincha, ² Ecuador	48	44	18	14	13
Santa Isabel, ² Col.	49	43	20	14	13
Choachi, ² Col.	48	44.5	19.5	14.5	12
Choachi, ² Col.	47	43	20	14	11.5
Caracas, ³ Venezuela	43	41.3	16	12.5	11
Caracas, ³ Venezuela	44.5	43.5	16	13	11.5
Escorial, ³ Venezuela	42	42	16	13	11.5
Sierra Nevada, ⁴ Mérida, Venezuela	47	35.5	19	19	12
Conejos, ⁴ Mérida, Venezuela	46	35	18	19	12

¹A number of the following specimens are not sexed but there appears to be no appreciable sexual difference in size in this group.

²*Cistothorus platensis æquatorialis*.

³*Cistothorus platensis caracasensis*.

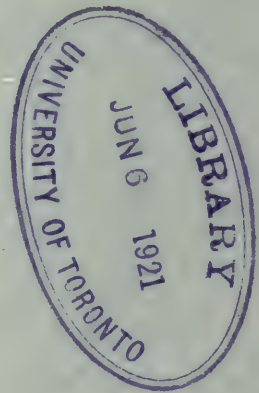
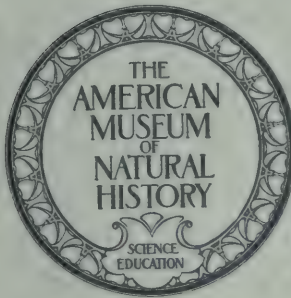
⁴*Cistothorus merida*.

AMERICAN MUSEUM NOVITATES

No. 3

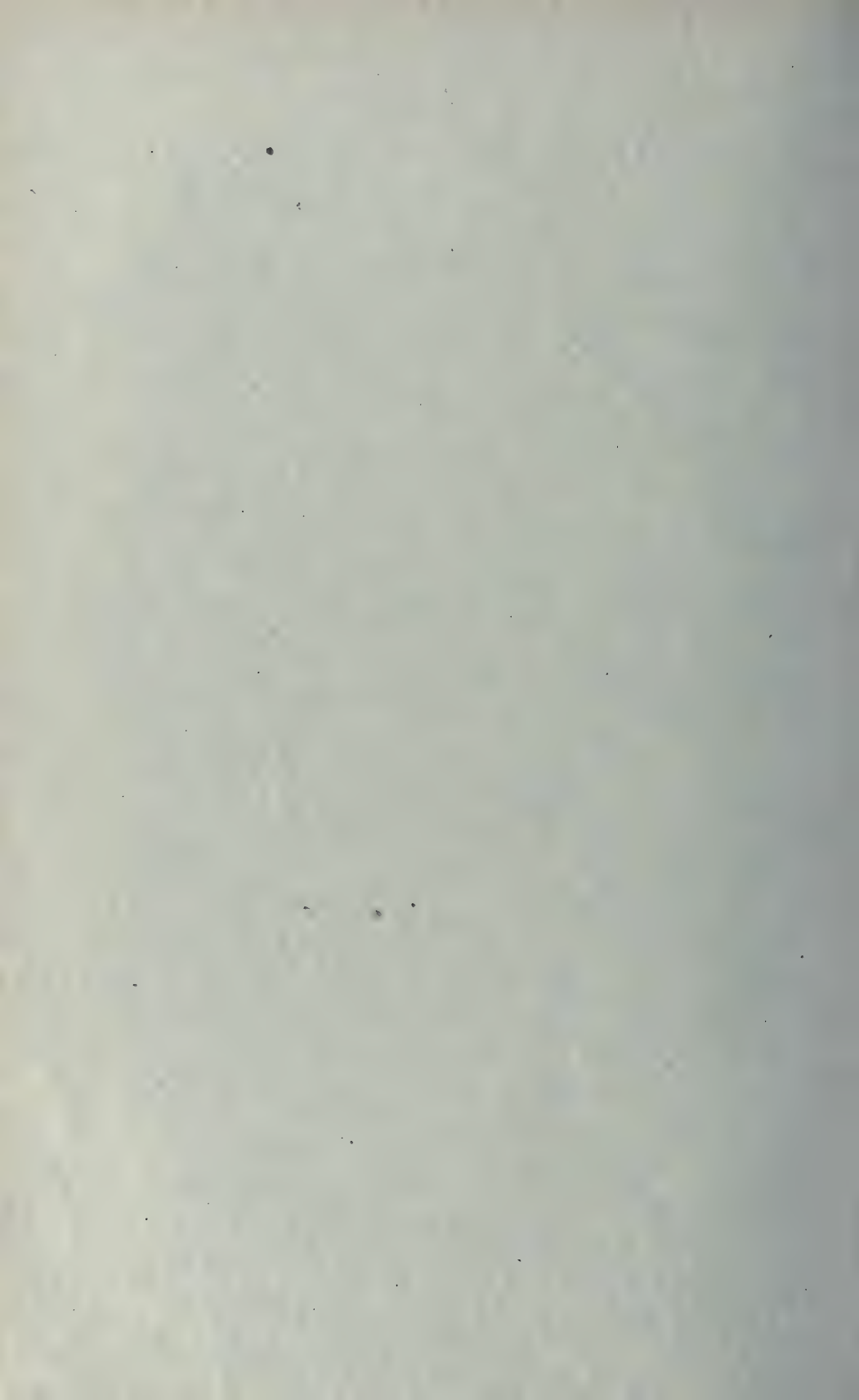
A HAWAIIAN RACE OF *CARANGOIDES* *GYMNOSTETHOIDES*

By JOHN TREADWELL NICHOLS



Issued March 9, 1921

BY ORDER OF THE TRUSTEES
OF
THE AMERICAN MUSEUM OF NATURAL HISTORY
NEW YORK CITY



AMERICAN MUSEUM NOVITATES

Number 3

March 9, 1921

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A HAWAIIAN RACE OF *CARANGOIDES GYMNO-STETHOIDES*

BY JOHN TREADWELL NICHOLS

The American Museum is in receipt of two specimens of *Carangoides* secured by Dr. B. W. Evermann in the Honolulu market, August 25, 1920, a little over a foot long to base of caudal.

In 'Fishes of the Hawaiian Islands,' 1905, Jordan and Evermann, two closely related species of this genus are recognized as *ferdau* (Forsk.) and *gymnostethoides* Bleeker. Our two specimens are referred to the latter as there described, though they agree exactly with neither one. As a matter of fact, they do not agree exactly with each other. One of them has a longer dorsal lobe (1.8 in depth of body, 2.0 in base of fin) and the ventral surface little paler in color than the dorsal. The other has a shorter dorsal lobe (2.0 in depth, 2.2 in base of fin), the ventral surface pale, and also differs somewhat in outline. This may be a sexual difference.

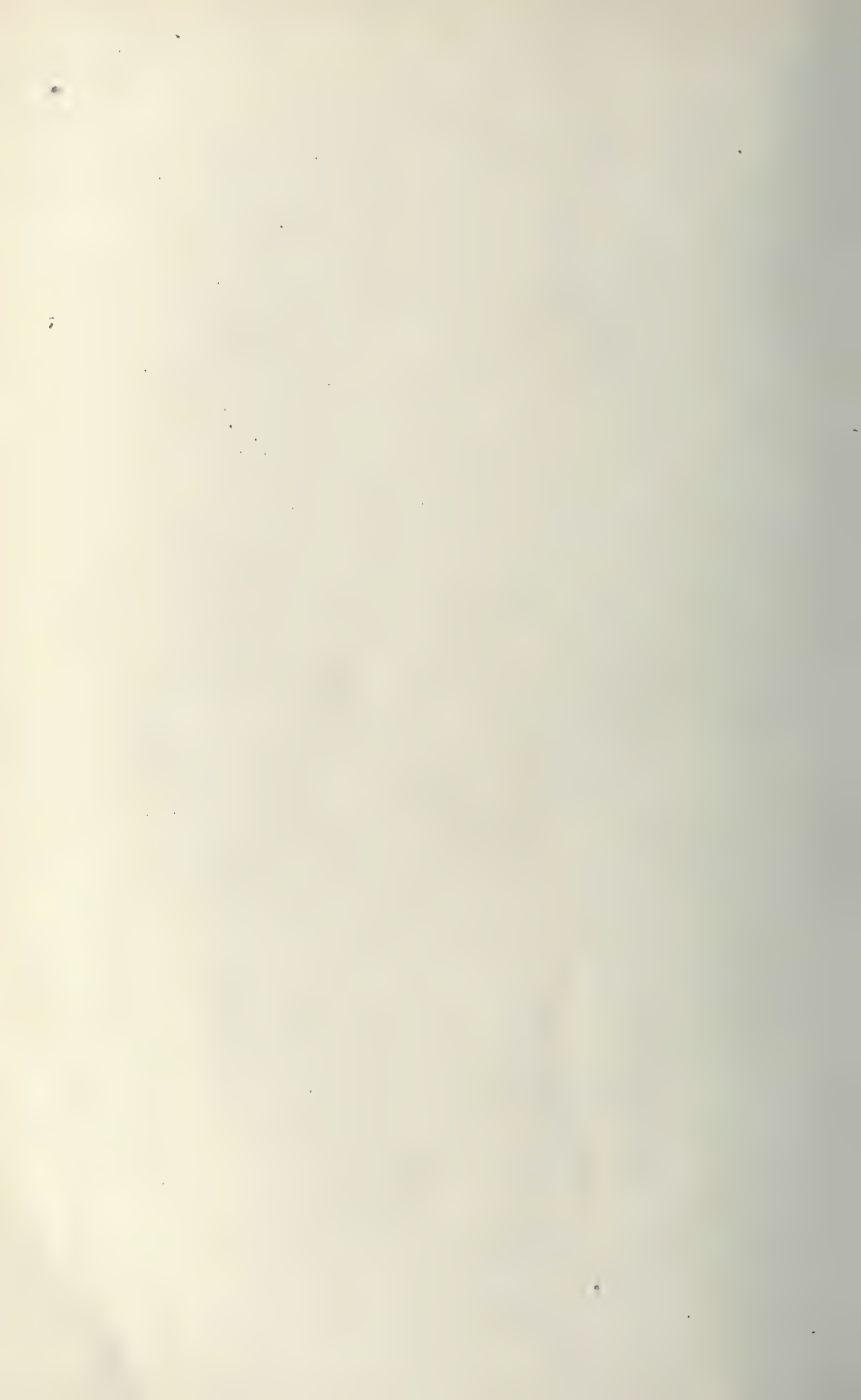
It further seems not impossible that *ferdau* from the Hawaiian Islands, Jordan and Evermann, is a variation of the same fish. True *ferdau* from the Red Sea and East Indies has appreciably fewer fin-rays.

Leaving out of consideration proportional head and depth measurements which vary with age in this genus, length of the maxillary separates *gymnostethoides* from *orthogrammus* from off the West Coast of North America, the maxillary not reaching below orbit in the former and extending to nearly opposite front of pupil in the latter. In our two specimens the maxillary just reaches the anterior edge of orbit, but it is described for Hawaiian *gymnostethoides* by Jordan and Evermann as reaching opposite front of pupil.

The head of *orthogrammus* is given as $2\frac{3}{4}$, which would be large for a fish with the accompanying depth of $3\frac{3}{8}$, and this may be a good character for that species. Also, in Hawaiian *gymnostethoides* the dorsal lobe is about $\frac{1}{2}$ as high as the depth of body and base of the soft dorsal, this being higher than described for typical East Indian *gymnostethoides* or for *orthogrammus*.



Fig 1. *Carangoides gymnostethoides evermanni*, new subspecies.
Type (left) and cotype (right).

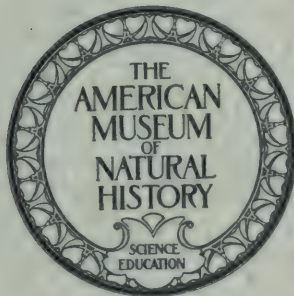


AMERICAN MUSEUM NOVITATES

No. 4

THE BONY STRUCTURE AND PHYLETIC RELATIONS OF *SPHÆRODACTYLUS* AND ALLIED LACERTILIAN GENERA, WITH THE DESCRIPTION OF A NEW GENUS

By G. K. NOBLE



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AMERICAN MUSEUM NOVITATES

Number 4

March 10, 1921

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THE BONY STRUCTURE AND PHYLETIC RELATIONS OF *SPHÆRODACTYLUS* AND ALLIED LACERTILIAN GENERA, WITH THE DESCRIPTION OF A NEW GENUS

BY G. K. NOBLE

Sphærodactylus embraces a group of very small neotropical lizards including one species which is probably the smallest lizard in the world. It is not surprising that the osteology and closest affinities of the genus have remained until this time practically unknown. It is not my intention to give here more than a bare outline of the more important structural features of *Sphærodactylus* or to discuss points which do not add definite evidence of phyletic relations.

The various species of *Sphærodactylus* have been exhaustively studied by Dr. Thomas Barbour. He has ready for press an elaborate monograph on the group. Dr. Barbour has aided me greatly in my study of the osteology of *Sphærodactylus* and its allies. I am especially indebted to him for specimens of *Aristelliger*, *Phelsuma*, *Lathrogecko*, *Lepidoblepharis*, and *Gonatodes*. These specimens were received in exchange from the Museum of Comparative Zoology and are now incorporated in the collections of the American Museum.

COMPARISON OF STRUCTURAL CHARACTERS

Sphærodactylus possesses procœlous vertebræ. It would seem that it could no longer be ranged with the gekkonids but should be grouped with *Coleonyx* in the Eublepharidæ. A detailed study of the skeleton of *Sphærodactylus* has shown that it is not closely related to *Coleonyx*. A search for its nearest allies has involved the examination of the skeletons of many genera of gekkonids and eublepharids. Small differences have been observed in the material prepared. It has been difficult to determine the relative value of these differences. Those characters which have seemed the most important are discussed below.

Vertebræ and Ribs

The vertebræ of *Sphærodactylus* are procœlous, agreeing in detail with those of the eublepharids *Lepidoblepharis* and *Lathrogecko*, and but slightly different from those of *Coleonyx*. Two views of a single vertebra

of *Sphærodactylus* are shown in Figure 1. It will be noted that the vertebra is of a very simple type.

It was surprising to find that a cartilaginous or fibro-cartilaginous band extends in *Sphærodactylus* from about the middle of the neural arch to the angular portion of the head of the rib. The cartilaginous nature of this band and its position relative to the neural arch and rib strongly suggest that it is the last vestige of the tubercle, a character-

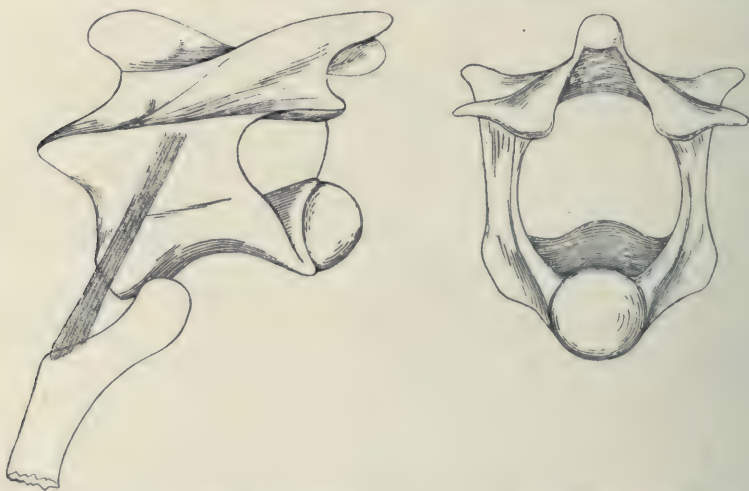


Fig. 1.—Vertebra (18th) of *Sphærodactylus macrolepis* Günther, lateral and posterior aspect. The former shows the cartilaginous tuberculum (stippled) of the rib.

istic structure of the ribs of primitive reptiles but one believed to have been entirely lost in the Lacertilia. Williston (1914, p. 33) states: "By the loss of the tubercle in lizards, the head became truly single-headed, and attached solely to the body; and this condition is characteristic of the order Squamata."

A cartilaginous tubercle, if such it may be called, is found not only in *Sphærodactylus* but also in *Lathrogecko*, *Lepidoblepharis*, and the neotropical species of *Gonatodes*. In *Coleonyx*, it is reduced, is more fibrous, and has a more anterior position than in *Sphærodactylus*. In all other lizards which I have examined, gekkonids, iguanids, teiids, xantusids, etc., this structure is represented by a ligament which is sometimes very slender and attached to the body of the vertebra near the articulation of the capitulum. In most iguanids and gekkonids, it is flattened and sometimes very difficult to distinguish.

Skull Structure

In addition to the procelous form of the vertebræ, one other character has been used to distinguish the Eublepharidæ from the Gekkonidæ. The parietals of the eublepharids are stated to be fused into a single element in contrast to the paired parietals of the latter group. The parietals of *Sphærodactylus* remain perfectly distinct throughout life. It would seem that this was a feature indicating a close affinity to the true gekkonids. An examination of the skulls of the various gekkonids and eublepharids at hand has convinced me that the fusion of the parietals into a single element cannot be considered diagnostic of the eublepharids. Most gekkonids possess paired parietals, but there are exceptions even within a genus. Thus, I find that while all the neotropical species of *Phyllodactylus* at hand have paired parietals, there is but a single element in *P. siamensis*. The single parietal is not a constant feature of all eublepharids. It is single in *Coleonyx variegatus* (Baird) and *C. elegans* Gray, but double in *Lathrogecko xanthostigma* Noble. It was described as single in *Lepidoblepharis festæ* Peracca but it is double in *Lepidoblepharis barbouri* Noble.

Cope (1892) pointed out some differences between the skull of *Coleonyx* and that of *Phyllodactylus*. I have compared skulls of the same genera but have failed to find any marked differences. There is a reduced jugal in *Coleonyx* as well as in *Phyllodactylus*. Cope, however, did not consider those differences which he found of great importance, since in a later report (1898, p. 464) he states that the skeleton of the Eublepharidæ "is similar" to that of the Gekkonidæ "except in the procelian vertebræ and single parietal bone."

Hyoid and Branchial Arches

Perhaps no one structure indicates the relationships of *Sphærodactylus* better than its hyoid apparatus. As shown in Figure 2A, the arches are very complete. The second epibranchial is well developed and is attached at both ends, a very unusual condition. The distal end is adherent to the exoccipital at the base of the paroccipital process; the proximal end is loosely attached to the second basibranchial some distance from the end. The hyoid arch is a simple bent rod. It is attached distally to the paroccipital process. The hyoid apparatus of a number of gekkonids has been figured. I have examined specimens of *Phyllodactylus* (3 species), *Thecadactylus*, *Hemidactylus*, *Aristelliger*, *Gehyra*, *Lygodactylus*, *Gekko*, *Tarentola* (2 species), *Pachydactylus*,

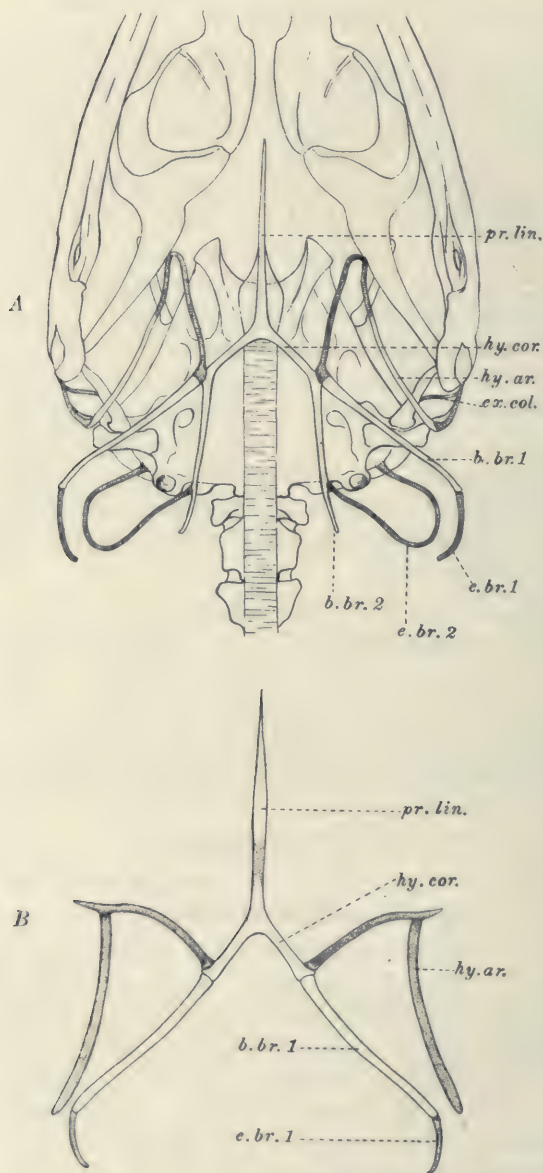


Fig. 2.—Hyoid Apparatus, ventral view. **A.**—*Sphaerodactylus macrolepis* Günther, *in situ* to show attachments. **B.**—*Paragonatodes dickersoni* (Schmidt), a typical gekkonid hyoid apparatus with a specialized hyoid arch and with the second branchial arch wanting.

B. br. 1 = basibranchial I; b. br. 2 = basibranchial II; e. br. 1 = epibranchial I; e. br. 2 = epibranchial II; ex. col. = extracolumella; hy. ar. = hyoid arch; hy. cor. = body of hyoid; pr. lin. = lingual process.

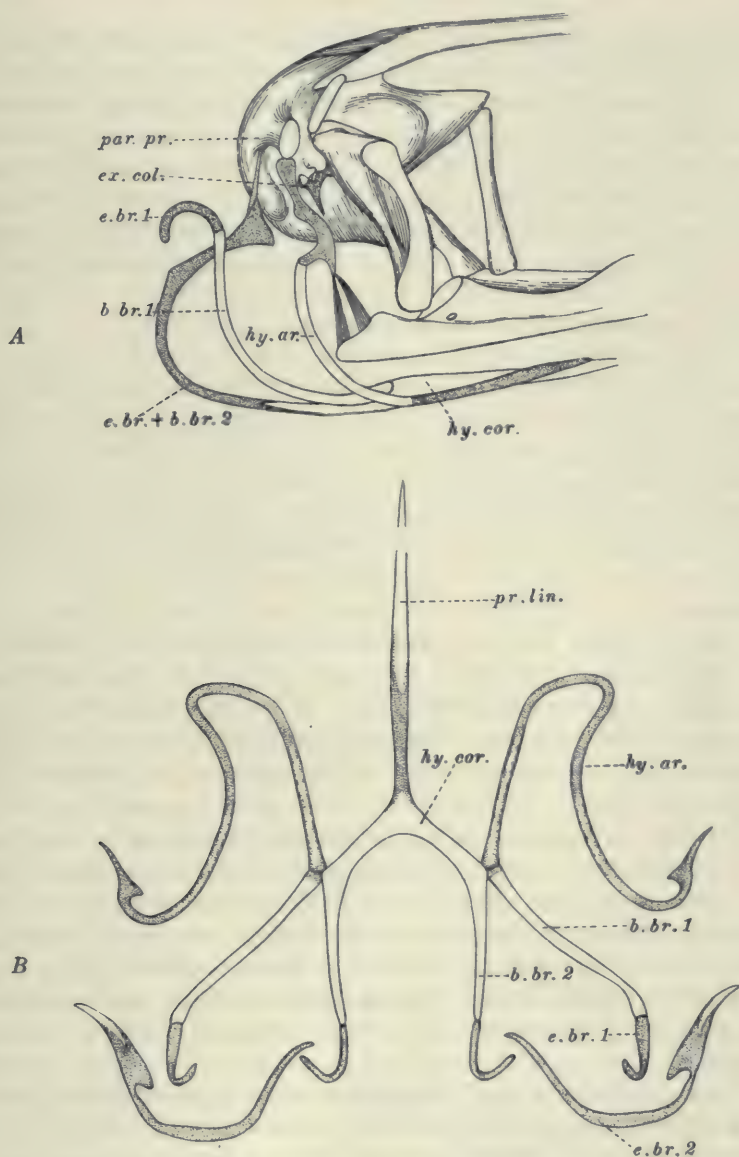


Fig. 3.—Hyoid Apparatus. A.—*Coleonyx variegatus* (Baird), lateral aspect of posterior part of cranium showing attachments of hyoid apparatus to skull. B.—*Lathrogecko xanthostigma* Noble, ventral view of the hyoid and branchial arches in their normal position.

B.br. 1 = basibranchial I; b.br. 2 = basibranchial II; e.br. 1 = epibranchial I; e.br. 2 = epibranchial II; ex.col. = extracolumella; hy.ar. = hyoid arch; hy.cor. = body of hyoid; par.pr. = paroccipital process; pr.lin. = lingual process.

Phelsuma, and *Gonatodes* (3 species). In none of these genera, except the neotropical species of *Gonatodes*, do the hyoid and branchial arches have a form and arrangement approaching the condition in *Sphærodactylus*. The arches of all gekkonids, with the exception just noted, are more or less reduced, especially the second branchial arch. The second epibranchial is generally present as a short and delicate cartilage lying free in the muscles and considerably removed from any attachment to either skull or basibranchials. In a number of specimens I could find no indication of such an epibranchial. It may not exist in the African gekkonid described by Schmidt as *Gonatodes dickersoni* (Figure 2B).

In the South American *Gonatodes atricucularis* Noble and *G. annularis* Boulenger, the hyoid is very similar to that of *Sphærodactylus*. The chief difference lies in the fact that the second epibranchial, although well developed, is loosely associated with the skull and is free from the basibranchial. These two species agree with *Sphærodactylus* in the long basibranchials, extensive epibranchials, and simple hyoid arch. No gekkonids, except the neotropical species of *Gonatodes*, have been found to agree with *Sphærodactylus* in possessing a combination of these three features.

It is remarkable that such a distinctive type of hyoid apparatus as that of the neotropical species of *Gonatodes* should be found in the eublepharids *Lathrogecko* and *Lepidoblepharis*. The arches of these two genera are identical and differ from that of *Gonatodes atricucularis* only in the slightly shorter first branchial arch and slightly larger arrow head to the second epibranchial. The distal end of the second epibranchial is not calcified in *G. atricucularis* as it is in the several specimens of *Lepidoblepharis barbouri* and a specimen of *Lathrogecko xanthostigma* (Figure 3B) which I have examined. In all three forms, the distal end of the second epibranchial is loosely attached to the paroccipital process and lies closely associated with the endolymphatic sac. It seems obvious that the presence of such a well-developed hyoid in *Sphærodactylus*, *Lepidoblepharis*, *Lathrogecko*, and the neotropical forms of *Gonatodes* indicates common ancestry.

The most primitive type of lacertilian hyoid apparatus is that found in *Coleonyx*. This was not realized until very recently (Fürbringer, 1919). The figure of Cope (1892, Pl. III, fig. 8) of the hyoid apparatus of *C. variegatus* is very incorrect. *C. variegatus* and *C. elegans* have similar hyoid and branchial arches. The second epibranchial is continuous with the second basibranchial and there is no suture or break between the two parts. The distal portion of this second branchial arch is attached very

loosely to the skull by a ligament. The cartilaginous portions of both hyoid and branchial arches have a characteristic form (Figure 3A). This very primitive type of hyoid apparatus found in *Coleonyx* seems to indicate that the genus has no close affinity to *Sphærodactylus*. If primary importance were arbitrarily laid on the form of the hyoid and branchial arches in determining relationships, it would follow that *Sphærodactylus* is more closely related to the gekkonid *Gonatodes* than to the eublepharid *Coleonyx*. Such is probably the correct view.

Pectoral Girdle

Sphærodactylus possesses a typical gekkonid shoulder girdle, with subcruciform interclavicle and expanded, perforated clavicle. Its pectoral girdle differs radically from that of *Coleonyx* in having four instead of three ribs attached to the sternum. The other two genera of neotropical eublepharids agree with *Sphærodactylus* as regards the sternal ribs but differ in the form of the clavicle. In neither *Lepidoblepharis* nor *Lathrogecko* is the clavicle perforated.

Altogether too much emphasis has been laid on form of the clavicle as defining the larger groups of Lacertilia. It is now well known that a number of iguanids possess expanded and perforated clavicles. The expanded, perforated clavicle cannot be considered a diagnostic feature of all gekkonids. The clavicle of the neotropical species of *Gonatodes* (Figure 4A) is not more expanded than many so-called cylindrical clavicles.

If one considers the slightly dilated clavicle of the neotropical species of *Gonatodes* (Figure 4A) as the primitive type, one can readily derive from that the conditions found in the neotropical eublepharids. The clavicle of *Lathrogecko* is slightly more dilated than that of *Gonatodes*. In *Lepidoblepharis* (Figure 5A) it is still more expanded. In *Sphærodactylus* (Figure 5B), the expanded portion has become fenestrated. The series exhibited by *Gonatodes*, *Lathrogecko*, *Lepidoblepharis*, and *Sphærodactylus* illustrates beautifully how the clavicle might have been gradually expanded and in the extreme stage thinned out until a foramen was formed. There is much reason to believe that we have in this series of genera a natural group and that the expanded, perforated clavicle has been evolved from the cylindrical one.

It may be well to mention at this point that the subcruciform interclavicle is not always present in the gekkonids. I have found that the African *Gonatodes dickersoni* and the Madagascarian *Phelsuma laticauda*

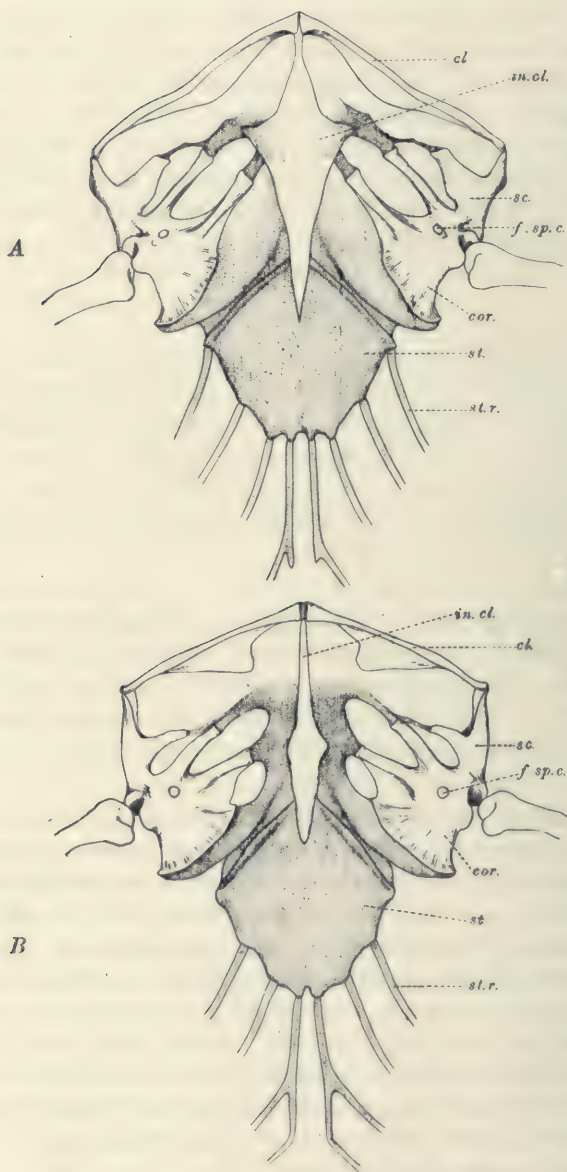


Fig. 4.—Pectoral Girdles, ventral aspect. A.—*Gonatodes atricucularis* Noble.
B.—*Paragonatodes dickersoni* (Schmidt).

Cor. = coracoid; cl. = clavicle; f.sp.c. = supracoracoid foramen; in.cl. = interclavicle; sc. = scapula;
st. = sternum; st.r. = sternal rib.

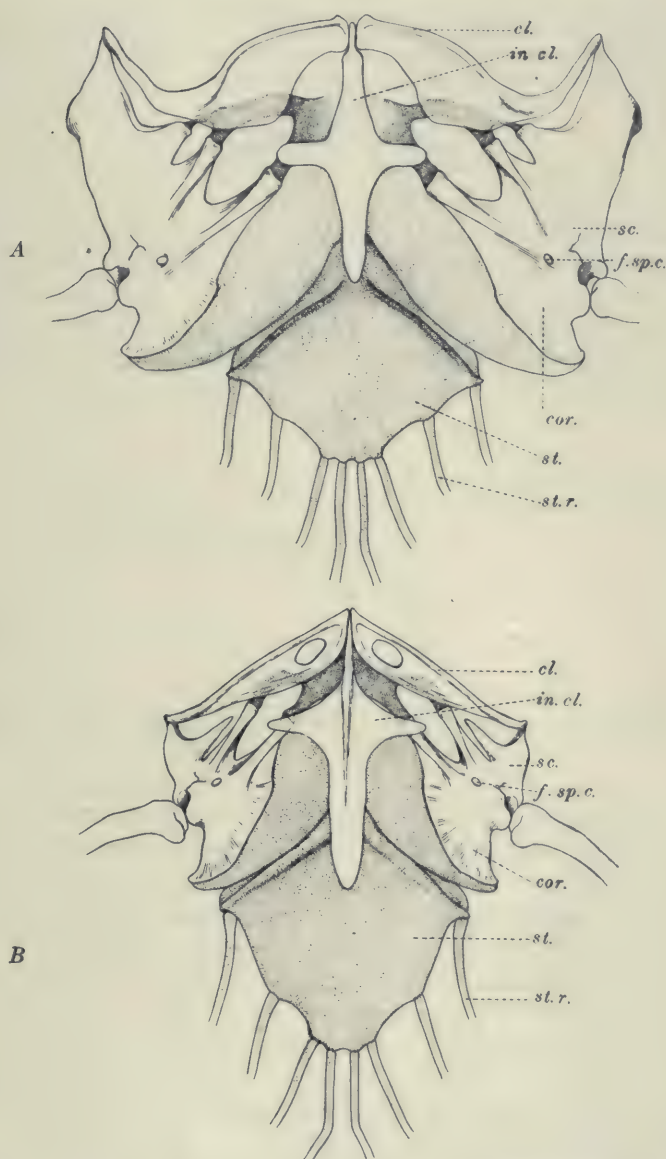


Fig. 5.—Pectoral Girdles, ventral aspect. A.—*Lepidoblepharis barbouri* Noble. B.—*Sphærodactylus macrolepis* Günther.

Cor. = coracoid; cl. = clavicle; f. sp. c. = supracoracoid foramen; in. cl. = interclavicle; sc. = scapula; st. = sternum; st. r. = sternal rib.

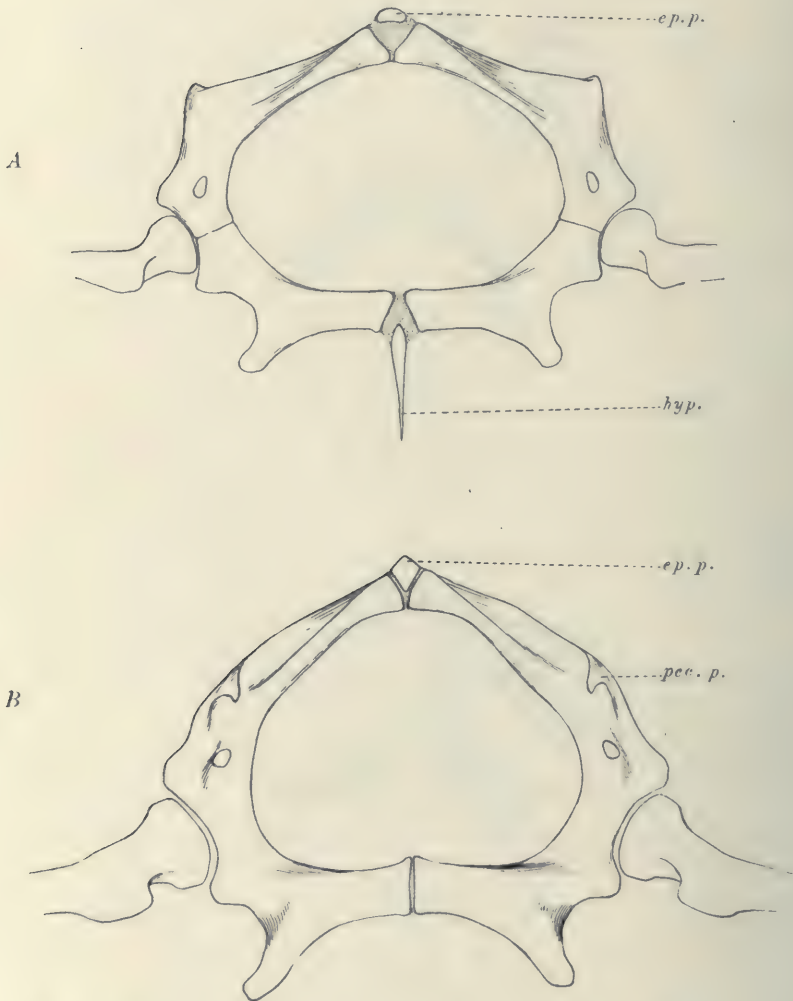


Fig. 6.—Pelves, ventral view. A.—*Paragonatodes dickersoni* (Schmidt.) B.—*Sphaerodactylus macrolepis* Günther.

Ep.p. = epipubis; hyp. = hypo-ischium; pec.p = pectineal process.

have the transverse arms of the interclavicle reduced or wanting. The former species differs greatly from the neotropical species of *Gonatodes* in having only three sternal ribs (Figure 4B).

Pelvis and Cloacal Bones

Gonatodes dickersoni differs from the neotropical species of *Gonatodes* in the form of its pelvis (Figure 6A) and the presence of cloacal bones in the male. The pubis has a very small pectineal process in *G. dickersoni* and there is a well-developed hypo-ischium and epipubis. The pubis of the neotropical species of *Gonatodes* agrees with that of *Lathrogecko*, *Lepidoblepharis*, and *Sphærodactylus* in the large pectineal process directed ventrally. The hypo-ischium may be very rudimen-

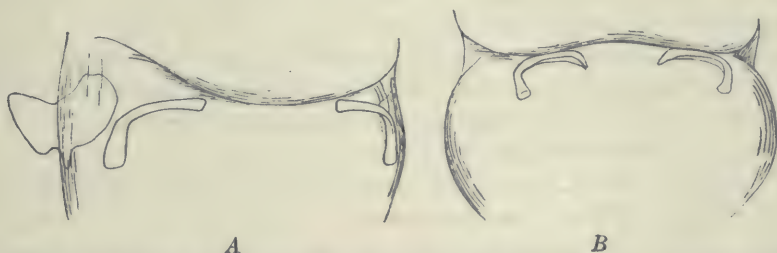


Fig. 7.—Cloacal Bones, showing relation to the cloacal slit. A.—*Coleonyx variegatus* (Baird). B.—*Paragonatodes dickersoni* (Schmidt).

tary or wanting in *Sphærodactylus* (Figure 6B) and is wanting in the other genera. In *Coleonyx* there is no hypo-ischium, but there are two pairs of large cloacal bones (Figure 7A), one pair projecting through the skin.

Very little reference appears in the literature in regard to the cloacal bones. Lying free near the hemipenes and below the skin, they have been often overlooked. The hypo-ischium has been often called an os cloacæ. The hypo-ischium and cloacal bones should not be confused. They are neither homologous nor analogous. I find the greatest development of cloacal bones in *Pachydactylus maculatus* where, in addition to a broad fenestrated median bone lying transversely across the anterior lip of the cloaca, there is a pair of irregularly shaped bones posterior to either corner of the cloacal slit. The hypo-ischium in this species is very long. In the several species of *Phyllodactylus* which I have examined, the males are provided with cloacal bones very similar in form to those of *Gonatodes dickersoni*.

External Characters

The obvious external similarity of *Gonatodes* and *Lepidoblepharis* has been pointed out by Peracca (1897). Of the three features emphasized by Ruthven (1916) in distinguishing *Lathrogecko* from *Lepidoblepharis*, only one, that of the form of the digits, can be considered of generic importance. It is apparent from a study of both internal and external structure that *Lathrogecko* is closely allied to *Lepidoblepharis*. *Sphærodactylus* agrees with *Gonatodes*, *Lathrogecko*, and *Lepidoblepharis* in the slender form of the body, the narrowness of the head, the arrangement of labials, rostral, and nostril, and the shape of the pupil. Some species of *Sphærodactylus* agree with some species of *Gonatodes* in the pronounced sexual dimorphism and general color pattern. Still, it has been very difficult to pick out any definite external characters which demonstrate a closer relation between *Sphærodactylus* and the above genera than between *Sphærodactylus* and any other gekkonoid groups. Cope (1898) seemed prepared to believe that *Sphærodactylus* was closely allied to *Phyllodactylus*. Most other reviewers have considered that the form of the digit tips in *Sphærodactylus* warranted the placing of that genus in an isolated position in any scheme of phylogeny adopted.

A careful examination of the digits of *Sphærodactylus* will show that their terminal dilations are composed of scales having the same mutual relations as those which make up the claw sheath in *Lepidoblepharis*. It would seem that an asymmetrical enlargement of one side of the claw sheath of *Lepidoblepharis* would give exactly the condition found in *Sphærodactylus*. In *S. macrolepis* and apparently throughout the genus, this enlargement has been the outer scales of the claw sheath in the pes and the outer on all the digits of the manus except the fifth, where it has been the inner side of the original sheath which has become enlarged to form the disk.

The homology of these scales becomes much more obvious if the claw sheaths of *Gonatodes* and *Lathrogecko* are compared at the same time. It seems fairly certain when these sheaths are arranged in a series that we have before us an actual phylogenetic sequence. The claw sheath of *Lathrogecko* (Figure 8B) may have been derived directly from that of the neotropical species of *Gonatodes* by an enlargement of the terminal scales of the digits. The claw sheath of *Lepidoblepharis* (Figure 8C) could have been developed from the sheath of *Lathrogecko* by the dropping out of the second median scale. Finally, the disks of *Sphærodactylus* are understandable only if we assume that they were formed from the *Lepidoblepharis* claw sheath by the asymmetrical enlargement of the

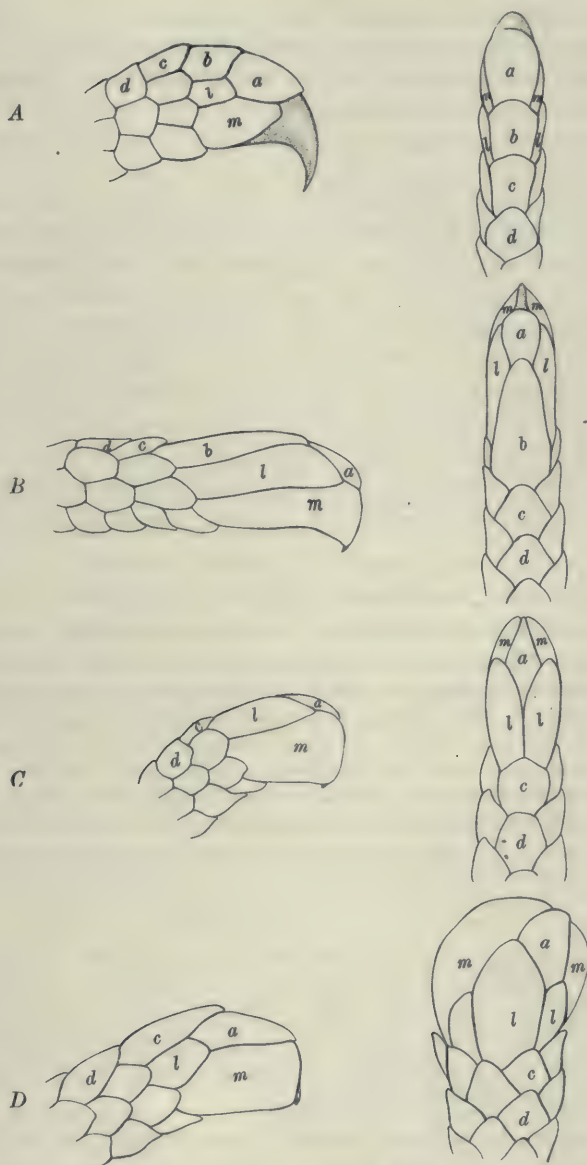


Fig. 8.—Claw Sheaths illustrating four stages in a single line of specialization. Homologous scales bear the same letters; original dorsal scales, *a*–*d*; laterals, *l* and *m*. A.—*Gonatodes atricucularis* Noble. B.—*Lathrogecko xanthostigma* Noble. C.—*Lepidoblepharis barbouri* Noble. D.—*Sphærodactylus macrolepis* Günther.

scales on one side of the sheath. The steps assumed in the change from the *Gonatodes* to the *Lathrogecko* to the *Lepidoblepharis* types of sheath are not great; the step from the *Lepidoblepharis* to the *Sphærodactylus* type is less clear but no less admissible.

PHYLOGENETIC RELATIONS

It follows from the above résumé of distinctive characters that the eublepharids, *Sphærodactylus*, *Lepidoblepharis*, and *Lathrogecko*, are closely related to each other and to the neotropical species of the gekkonid *Gonatodes*. At least one of the Old World species of *Gonatodes*, and probably all, has no close affinity to the neotropical forms. Since the genus *Gonatodes* was based on a neotropical species, a new name will have to be proposed for Old World forms, or for at least the one species which we have studied in detail. It is probable that this new genus will embrace all three African species, less probable that it will include the East Indian forms which have until now been referred to *Gonatodes*.

PARAGONATODES, new genus (Gekkonidæ)

TYPE.—*Gonatodes dickersoni* Schmidt. (Type locality, Medje, Belgian Congo.)

DIAGNOSIS.—Digits slender, clawed; the distal portion of the digits slightly compressed and forming an angle with the claw; these distal portions covered beneath with a single series of scales distally, and with a double series of much smaller ones proximally (see Schmidt, 1919, fig. 6); body slender, with granules and tubercles above, with small scales below; tail cylindrical; pupil circular; eyelid distinct around eye. Hyoid apparatus reduced; no second basibranchials; no second epibranchials (Figure 2B); interclavicle dagger-form, no transverse arms; clavicle dilated but not fenestrated (Figure 4B); only three sternal ribs; pectineal process of pubis rudimentary; a well-developed hypo-ischium; male with a single pair of bow-shaped cloacal bones (Figure 7B); ligamentous tubercle of the ribs much reduced and proximated to the capitulum.

It seems extremely probable that *Sphærodactylus*, *Lepidoblepharis*, and *Lathrogecko*, with their procœlous vertebræ, four sternal ribs, cartilaginous tuberculum, distinctive hyoid, pelvis and cloacal regions, form a natural group of genera. These genera show closer affinity to *Gonatodes* than to any other gekkonid.

Evidence has been brought forth to show that we have in this group a natural series commencing with *Gonatodes*, and leading through *Lathrogecko* and *Lepidoblepharis* to *Sphærodactylus*. It is believed that this series represents an actual morphogenetic sequence. The more important changes which occurred in this series may be listed. (1) The vertebræ

changed from amphicœlous to procœlous, and most of the intercentra were lost. (2) The second epibranchial lost its characteristic arrow-shaped head and became attached to the exoccipital near the base of the paroccipital process. The proximal end of the second epibranchial migrated anteriorly and became loosely attached to the second basi-branchial. (3) The clavicles evolved from narrow but flattened rods to broadly expanded sheets, and finally thinned out in their proximal portions to form median fenestræ. (4) The terminal scales of the digits became elongated to form six-scaled claw sheaths. The posterior dorsal of these six scales dropped out to form five-scaled sheaths. Finally, there was an asymmetrical enlargement of one side of the sheaths to form disks.

It is important to emphasize that this series of steps has only been assumed after a study of all the genera of gekkonids and eublepharids available to me; that *Gonatodes*, *Lathrogecko*, *Lepidoblepharis*, and *Sphærodactylus* have more in common with each other than can be found between *Sphærodactylus* and *Coleonyx*, or *Gonatodes* and any of the ten other genera of gekkonids at hand. In other words, it seems extremely likely that, among other things, the procœlous vertebræ have been developed in this series quite independently of similar changes in any other series. It follows that in all probability the Eublepharidæ had a polyphyletic origin and, instead of being a very ancient group as hitherto believed, they may be a very recent assemblage, even if a conservative one.

It has been suggested that the gekkonids are degenerate forms, their amphicœlous vertebræ secondary structures. There is obviously nothing primitive in the highly reduced skull of the gekkonids. *Coleonyx* with its very primitive hyoid possesses procœlous vertebræ. Xantusids with procœlus vertebræ also have primitive hyoids, and I have found that *Xantusia vigilis* retains the intermedium in the carpus as further evidence of its ancestral position among primitive Lacertilia. Why, then, should we not reverse our series and evolve *Gonatodes* from *Sphærodactylus* or at least *Lathrogecko*? This would necessitate developing intercentra again, evolving cylindrical from expanded clavicles, and changing from specialized to primitive claw sheaths. Altogether too little is known about the osteology of the Lacertilia to be entirely certain about the direction in which evolution has progressed. The view I have outlined above seems at the present time the most probable.

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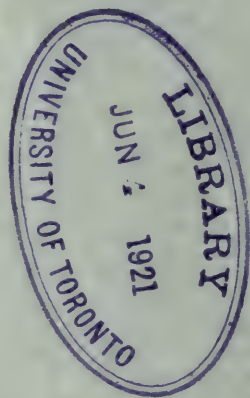
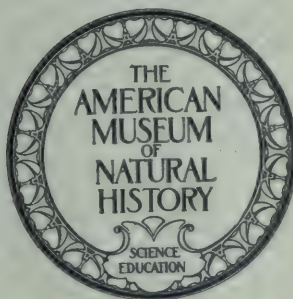
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AMERICAN MUSEUM NOVITATES

No. 5

GEOGRAPHIC AVERAGE, A SUGGESTED METHOD FOR THE STUDY OF DISTRIBUTION

By FRANK E. LUTZ



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GEOGRAPHIC AVERAGE, A SUGGESTED METHOD FOR THE STUDY OF DISTRIBUTION

BY FRANK E. LUTZ

Students of the distribution of animals and plants have divided North America, especially United States, into sections, within each of which the fauna or flora, or both, is believed to be more or less homogeneous and more or less distinct from other, corresponding sections. I must confess that these sections seem to me less distinct than they once did. It is a characteristic of human psychology that we classify and make categories where there are no definite classes or categories. We speak of north, east, south, and west. When we go more deeply into the subject we speak of northeast, southeast, and so on. At sea, however, we box the compass by such gradual steps that we have a continuous circle with no separate divisions. This does not mean that "north," "east," and so on are not convenient and useful conventions but, as a matter of fact, they are only very general terms. In the same way, there is no definite "arctic-alpine," "austral," and so on, and a definiteness can only be maintained for these zones by a special selection of "indicator species" or something of that sort. If this procedure be accepted, almost any sort of system of zones may be devised by selecting appropriate "indicators."

On the other hand, some system is convenient and useful. The carefully investigated system of Merriam, based on the fundamental studies of Allen, has been widely accepted. Can we take the proposed biotic areas and get some concrete expression for them that will be based on the biota as a whole? This expression should, if possible, be something that will help us to say with a fair degree of assurance that a given limited area or a given species belongs in this section or that. After trying a number of different methods of getting such an expression, it seems to me that what I am calling the "geographic average" gives the best promise.

Partly because plants are a large determining factor in the distribution of animals and partly because it was convenient to use the data given in Britton and Brown's 'Illustrated Flora of the Northern States and Canada,' the illustrations given here are based on data secured from the second volume of that work, Portulacacæ to Papilionacæ, inclusive. There was no reason for taking this portion of the flora rather than some

other; I merely wanted a random sample. The only species intentionally omitted from this lot were those that were said to have been introduced by man and a few in which the distributional range was not clear to me.

The limits of the range of a species outline a polygon. If we are given the latitude and longitude of these limits we can average them and get the latitude and longitude of a point which is approximately in the center of the range of a species.¹ This would be the geographic average of that species, and it would indicate rather clearly whether the species tends to be northern or southern, eastern or western. Having calculated the geographic averages of each of an aggregate of species (those in a particular sphagnum bog, or at a given altitude on a certain mountain, or in a given political division, or what not) one could average these species averages and get a geographic average for the aggregate under consideration.

In Britton and Brown's 'Flora' the range of each species is stated by giving the names of the states or other political divisions to which the species extends. I took the approximate center of each of these political divisions as the limit of the range in that direction and calculated geographic averages for each species. On the basis of the 77 of these that occur in Labrador, I found that the geographic average in North America, including Greenland,² of the Labrador flora is at about 51° N., 89° W., with an average range in latitude of about 20° and in longitude of about 79°. If the complete flora were considered, this average might be somewhat different but, as a first approximation, it indicates that, in North America, the flora of Labrador is one that centers a little south of Hudson Bay and, on the average, extends southward to about the latitude (41° N.) of southern New York or northern Colorado and westward to about 130° W., say British Columbia.

Britton and Brown's 'Flora' concerns itself only with northeastern North America. Taking up several areas along the northern Atlantic slope and basing the averages on species of plants from *Portulacaceæ* to *Papilionaceæ*, inclusive, we get the following.

¹If the range were crescentic in shape, the geographic average might be a point between the horns of the crescent, where the species does not, in fact, exist.

²I did not use limits in Asia or Europe in calculating these averages; they were not given definitely and did not seem important for what I had in mind. Of the 91 North American species which occur in Palearctica and for which I have calculated the geographic averages, 12 that occur in Asia but not in Europe have a geographic average of 48° N. (Range, 22°), 95° W. (Range, 79°), and 14 that occur in Europe but not Asia have a geographic average of 49° N. (Range, 13°), 78° W. (Range, 42°). The numbers on which these averages are based are too small to be entirely significant and they are based only on species of northeastern North America. A study based on fuller data is being prepared.

	Geographic Average		Average Range	
	Latitude	Longitude	Latitude	Longitude
Labrador	51°	89°	20°	79°
Newfoundland	48	87	20	70
Nova Scotia and New Brunswick	45	87	19	56
New England	42	85	17	44
Md., Va., and Del.	39	85	14	26

It is clear, as would be expected, that the average latitude decreases as we take more southern areas but it might not have been so certainly anticipated that the longitude would also decrease, that is, that the geographic average of the areas would steadily move eastward although the areas in question are more and more western. This seems to be bound up with the further fact that the average longitudinal range¹ decreases steadily and markedly as we pass from north to south. The similar decrease in the average latitudinal range, while not so great, is more surprising, as one might have expected that Labrador species, being restricted by extreme arctic conditions from spreading in a northward direction would have a less average north-and-south range than those in Virginia, for example, which have a great distance, both north and south, to which they can spread.

It is true that a study of the average ranges of 386 species of plants native to northeastern North America shows that there is a close positive correlation between the extents of latitudinal and longitudinal ranges but I do not think that this, coupled with the relatively wide longitudinal range of northern species,² is a full explanation of the wide latitudinal range of such species. Perhaps the explanation is that a species which is able to survive difficult northern conditions finds it easy to live in a relatively wide range of other conditions, while the same is not true of the more southern species.

Labrador is in what was called the Barren-Ground Fauna of the Arctic Realm by Allen and the Arctic Zone of the Boreal Region by Merriam. There is little or nothing from farther north which might

¹Longitudinal range as measured by degrees of longitude. It should be remembered that a degree of longitude is not as many miles in higher latitudes as in more equatorial ones. However, this difference is not great enough between Virginia and Labrador to negative the indication that, among these plants of northeastern North America, the more northern ones tend to have a wider east-and-west distribution than the more southern ones.

²Not only is the average longitudinal range in North America of the Labrador species considered here 79°, as compared with 26° for those in Virginia, but other data on the Labrador flora as a whole show that 72% of the Labrador flora occur also in Palearctica.

have extended out of its "regular" range into Labrador, but it is conceivable that really southern things got into unusually favorable, ecologically speaking, situations in Labrador and were able to survive there, at least long enough to be collected and recorded by the botanists. These latter plants, classed as Hudsonian, would, for the most part, have a range along eastern North America southward from Labrador. The material from Labrador can be analyzed as follows.

	Average Latitude	Average Longitude
(A) 40 species that do not occur far directly southward	54°	90°
(B) 37 species that occur directly southward	49	85

The number of species is small for the purpose of computing averages and the grouping is admittedly rough but, as an illustration of method and until we have something better, we can take the geographic average for A as that of the Arctic¹ and the one for B as that of the Hudsonian.

Newfoundland is considered by Allen to be partly in the Cold Temperate Subregion and partly in the Arctic Realm. Merriam divides it between the Arctic, Hudsonian, and Canadian Zones of the Boreal Region.² The present material may be analyzed as follows.

	Average Latitude	Average Longitude
(C) 57 species which range north of Newfoundland	50°	89°
(D) 27 species which occur in Newfoundland but not in Labrador	44	83

Of these, C is doubtless a mixture of Arctic and Hudsonian; and D may be largely Canadian.

Nova Scotia and New Brunswick are entirely in the Cold Temperate Subregion (Canadian Fauna) of Allen but Merriam recognizes Alleghanian Zone of the Austral as well as Canadian Zone of his Boreal Region. The geographic averages of 152 plants from there may be analyzed as follows.

¹The geographic average in North America (including Greenland) of 20 Labrador plants that occur in Greenland is 54° N., 81° W.

²His map, 1912, Canadian Entomologist, XLIV, opposite p. 128, shows some yellow and blue, indicating Upper Austral and Transition. I do not know whether he meant this or whether it is due to faulty registration of the color-plates in printing.

	Average Latitude	Average Longitude
(E) 56 species that occur also in Labrador	50°	90°
(F) 26 species that occur also in Newfoundland but not in Labrador	44	85
(G) 70 species that occur in neither Labrador nor Newfound- land	42	86

Of these, E probably represents a mixture of Arctic and Hudsonian species that extend south; F may be largely Cold Temperate (Canadian) species; and G may be Alleghanian.

The geographic average for 207 New England plants is stated above to be 42° N., 85° W. Analyzing it in the same way as was done above for the material from Nova Scotia and New Brunswick, we get the following results.

	Average Latitude	Average Longitude
(H) 40 species that occur also in Labrador	48°	89°
(I) 24 species that occur also in Newfoundland but not in Labrador	44	84
(J) 69 species that occur also in Nova Scotia or New Brunswick but not northeast of there	42	86
(K) 74 species that do not occur northeast of New England	39	84

Four classes of plants may be considered to be present here: probably largely Hudsonian with a geographic average of 48° N., 89° W.; the Canadian with a geographic average of 44° N., 84° W.; the Alleghanian with a geographic average of 42° N., 86° W.; and an element of warmer-region plants with a geographic average of 39° N., 84° W. This last element is probably to be identified with Allen's Carolinian Fauna of the Humid Province of the Appalachian Subprovince of the Warm Temperate Subregion, or with the Carolinian of Merriam's Upper Austral.

The following is an analysis of the geographic averages of 282 plants that occur in Maryland, Virginia, or Delaware.

	Average Latitude	Average Longitude
(L) 12 species that occur also in Labrador	46°	89°
(M) 11 species that occur also in Newfoundland but not in Labrador	42	84
(N) 57 species that occur also in Nova Scotia or New Bruns- wick but not northeast of there	41	86
(O) 150 species that do not occur northeast of New England	38	84
(P) 52 species that do not occur northeast of Md.	34	84

What is apparently a new element (P) here might be considered to be the coming in of plants that would be classed in Allen's Austroriparian Subprovince (Louisianian Fauna) of the Humid Province of the Warm Temperate Subregion or of Merriam's Austroriparian Fauna of the Lower Austral Zone. As they are only the more northern species, the latitudinal average for this distributional section as a whole is doubtless less. O may be largely Carolinian; N, Alleghanian; L and M each have too few species to make the averages even approximately trustworthy.

Collecting the data, we get the following provisional suggestions as to the latitudinal averages for various regions.

Arctic	More than 52° N.
Hudsonian	48 or 49° N. ¹
Canadian	44 or 45° N. ¹
Alleghanian	41 or 42° N. ¹
Carolinian	38 or 39° N.
Louisianian or Austroriparian	Less than 34° N.

The tabulation just given indicates, at first sight, that these regions are definite, concrete entities, but, when we bear in mind that they were derived by first grouping the data into disconnected lots, we realize that another grouping might fill in the gaps. Furthermore, they are averages in which we lose sight of the extremes of each group. On the other hand, as stated above, categories, even if only conventional, are often useful aids to thinking and it might be well if we had concrete expressions for our categories—something more definite and tangible than mere names. I believe that the "geographic average" is such a concrete expression. I do not mean to intimate that the figures just obtained should be considered final, even for the regions that have been studied here. Although they are based on considerable material, this material includes only a small part of the plants of these regions and it does not include any of the animals. Also, it includes only relatively small areas of each section ("zone" or whatever we wish to call it). Furthermore, altitude and other ecological conditions have been disregarded.

I have been unable to devise, as yet, satisfactory corrections for altitude. Doubtless it could be done in the following way. We could study a limited area containing a wide altitudinal range, for example,

¹It will be noted that these are south of the principal boundaries of the "zones" in question, as given in Merriam. The finger-like southern extensions of the zones along mountain ranges is one of the causes and the discrepancy will be less when the corrections for altitude have been worked out. However, it is a matter of little moment, since the geographic average need not necessarily fall within the area actually covered by the species or the aggregate of species under consideration.

North Carolina, Virginia, or the central part of Colorado or of California. We could then calculate the geographic averages for various altitudes, keeping other ecological conditions, such as soil, exposure, etc., as nearly uniform as possible. We might get, in this way, a fairly accurate, concrete expression for the known fact that going to higher altitudes is, faunistically and floristically, analogous to going to higher latitudes and we might also get a factor for modifying our data so that, instead of working with the exact latitude of a place on a mountain, we could work with a modified figure, the modification being greater as the altitude is greater. In much the same way, the geographic average lends itself to a study of other ecological conditions.

Having obtained fairly approximate expressions in average latitude and longitude for each of the zonal names that we care to accept as a matter of convenience, we can then say rather definitely whether a certain animal or plant belongs in a given zone or not. This can be done by a comparison of its geographic average with the geographic averages of the zones. In the same way we can say whether a given small area is in one zone or another—or between two of them. One of our common bumble bees, *Bombus americanorum*, has a geographic average of approximately 38° N., 92° W. Its latitudinal average would put it in Carolinian, on the basis of the tabulation given above. Its longitudinal average is greater (farther west) than the longitudinal average of the areas studied here having the same latitudinal average.

The matter of longitudinal average is important in connection with the change in humidity that occurs at about 100° W. in the United States. Allen made this the basis upon which he divided the Warm Temperate Subregion into Provinces (Humid and Arid). Merriam laid more stress on temperature than on humidity and considered the latter as causing merely a subdivision of certain of the zones that were based on temperature. I, personally, incline more to the former idea than to the latter, especially where the latitudinal average is less than about 40° N., but I do not yet have enough data to discuss the question further.

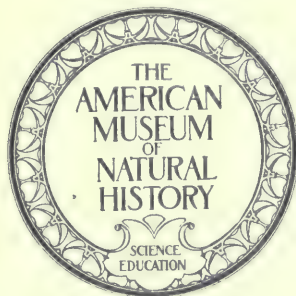
The present paper is intended to outline a method, rather than to state results obtained by the use of the method. This method of geographic averages is suggested as a better tool for the study of distribution than, for example, indicator species or percentages of species from one area occurring in another. Incidentally, it has been indicated that the named "regions," "zones," etc. are far from the definite entities that they often seem to be. At the same time, what are believed to be first approximations to concrete expressions have been obtained for some of them.

AMERICAN MUSEUM NOVITATES

No. 6

DESCRIPTION OF A NEW SPECIES OF SEROW FROM YÜN-NAN PROVINCE, CHINA

By ROY CHAPMAN ANDREWS.

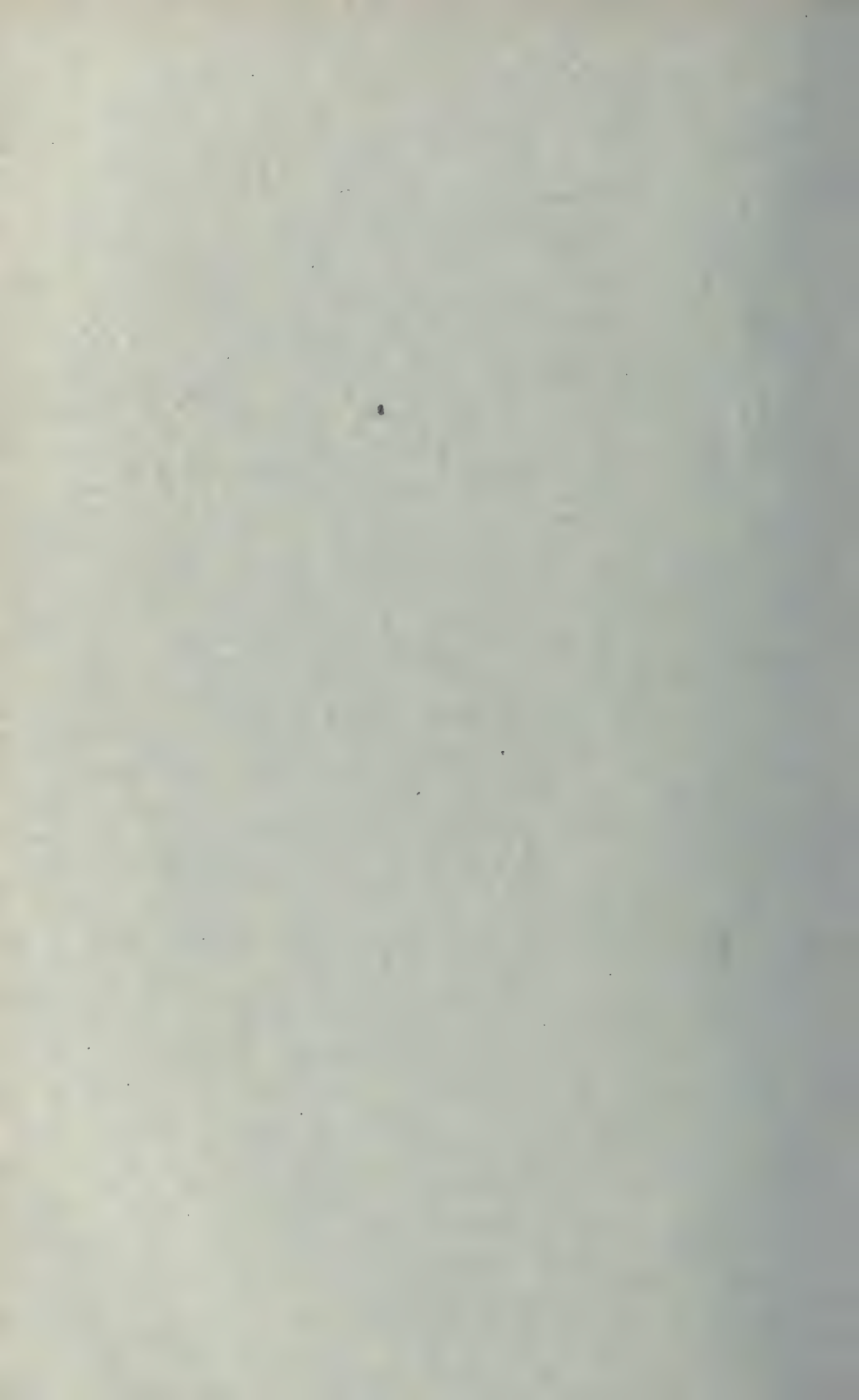


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DESCRIPTION OF A NEW SPECIES OF SEROW FROM YÜN-NAN PROVINCE, CHINA

BY ROY CHAPMAN ANDREWS

Although it is not the purpose to publish extensively upon the collections obtained by the Asiatic Expeditions of the American Museum until the field work has been completed, it is desirable to describe such new species as may come to light from time to time in the preliminary examination of certain groups.

The splendid serow which I shot near Teng-yüeh, China, not far from the Burma frontier, is the first animal to be described from the Asiatic collections, and I take pleasure in proposing for it the name *Capricornis osborni*, in honor of the distinguished President of The American Museum of Natural History, Professor Henry Fairfield Osborn.

Capricornis osborni, new species

Type No. 43042, ♀ juv., Hui-yao (20 miles from Teng-yüeh), Yün-nan Province, China, May 9, 1917; Roy Chapman Andrews.

Forehead, cheeks, neck, breast, and body coal black. The white basal parts of the hairs show through to a certain extent but the general effect is jet black. A narrow margin of white 6 mm. wide on upper lips from middle of snout to corner of mouth. Above this white band but below and behind the nostril on each side, is a triangular tawny patch. The lower lip is margined with white which occupies all except the central half of the chin and extends behind the corner of the mouth in a long, gradually narrowing streak; this almost reaches the white throat-patch which is about 40 mm. in width.

The proximal part of each ear in front is strongly tinged with tawny but on the back this is less pronounced and the ear is largely black. The short mane is intense black like the body, stiff, erect and crest-like; the hairs are about 120 mm. in length. From the mane to the tail, the hair of the mid-dorsal line forms a well-defined ridge. The tail is black in the center with an admixture of tawny hairs; the tip is all black.

Inside of fore legs to hoofs, tawny; externally, black to the knees; front of "cannon bones" black except at the knees where the black is indistinct and suffused with tawny. Just above the hoofs, the blackish area is thinly sprinkled with light buff and posteriorly, between the dew claws and the hoof, it is all light buff. Buttocks tinged with tawny. Thighs almost to hocks, black with slight admixture of tawny. Inner side of hind legs to hoofs tawny. From hocks to opposite dew claws, anteriorly, the legs are tawny but with a suggestion of blackish, due to the hairs which are black on the basal half and tawny on the tips. From opposite the dew claws to the hoofs the black is pronounced and thinly interspersed with buff-tipped hairs. The area between the dew claws and the hoofs, posteriorly, is all buff.

There is no underfur present on any part of the body.

Skull badly broken. Measurements of skull: condylo-basal length, 257 mm.; least orbital width, 68; width of palate between first premolars, 37; length of horn on curve, 117; circumference of horn at base, 95. External measurements of type: head and body, 1350; tail, 180; hind foot, 390; ear, 175; height at shoulder, 950.

Capricornis osborni is undoubtedly allied to our specimens from Li-chiang, Yün-nan Province, which I have identified as *C. milne-edwardsi*. Its chief distinguishing characters are its coal-black body and head, its short black mane and the greater amount of black on the lower part of the legs. Our four specimens of *C. milne-edwardsi* all have brownish-black bodies and heads, long whitish manes, and little or no black upon the lower legs. In the very heavy mat-like gray mane, my two specimens of *C. argyrochætes* from Fukien Province, China, differ strikingly from *osborni*, although in the amount and disposition of the black on the lower legs the two somewhat resemble each other. *C. swettenhami* of the Malay Peninsula is distinguished from *osborni* by the black legs and the mane, which is a mixture of whitish, black and reddish hairs.

In discussing *C. milne-edwardsi* Mr. R. I. Pocock¹ has remarked: "A closely allied form apparently resembling typical *milne-edwardsi* in color except that the fronts of the cannon bones appear to be black has been recorded by Mr. H. Shaw Dunn from Kyonklongyi and other localities in the North Shan States of Upper Burma where it lives mostly in evergreen forests at altitudes of from 4,500 to 6,000 feet (Field, Jan. 9, 1909.)."

I have not been able to discover Mr. Dunn's communication in the 'Field' but I have no doubt that the race I am now describing is the one to which he refers.

The serow which Lieut. R. C. Beavan² described as inhabiting the vicinity of Moul-mein, Burma, and which Mr. Pocock referred provisionally to *milne-edwardsi* may be this new form. While the affinities of *osborni* are toward *milne-edwardsi*, it is interesting as showing an approach toward *swettenhami* of the Malay Peninsula in the considerable amount of black on the legs and the short black mane.

Near Gengkang, Yün-nan Province, we purchased from a native a flat serow skin which lacks the head and lower legs. This specimen was said to have come from the mountains of Keng-ma about 200 miles southeast of Teng-yüeh and not far from the Burma frontier. It is brownish black

¹ 'The Serows, Gorals and Takins of British India and the Straits Settlements.' By R. I. Pocock. Part II. Journal, Bombay Natural History Society, XXII, pp. 307-308.

² 1866, Proc. Zool. Soc. London, p. 4.

in general color, has a short crest-like, brownish-black mane, similar in character to that of *osborni*, and what remains of the skin shows that both the fore and hind legs were whitish or light buff below the knees and hocks.

This specimen may possibly represent the male of *C. osborni*, for the differences are somewhat similar to those between the male and female of our *C. argyrochaetes* from Fukien.

I shot *C. osborni* near the village of Hui-yao while hunting monkeys on the precipitous bank of the river. The cliff was almost perpendicular and was covered with a tangled jungle growth. Now and then the rock wall would become less precipitous and the thick cover give place to an open grassy slope. It was when I was about to cross such an opening that the serow dashed out of the bushes where it had evidently been feeding. I fired just before it disappeared over the rim of the gorge and it sank in its tracks, gave a convulsive twist, and plunged into the canyon. It was recovered with considerable difficulty.

Although the natives knew that serows lived in this part of the gorge, few of them had ever seen one and it was an object of great curiosity in the village.

There is little change in the country between Hui-yao and the Burma frontier and no reason why *C. osborni* should not have an unrestricted range into Burma.

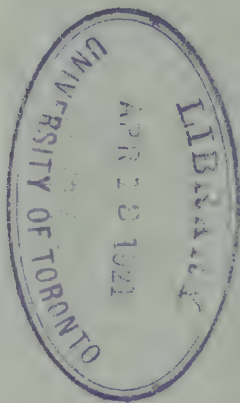
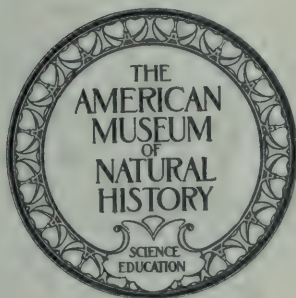


AMERICAN MUSEUM NOVITATES

No. 7

DESCRIPTION OF FOUR NEW BIRDS FROM THE BELGIAN CONGO

By JAMES P. CHAPIN



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AMERICAN MUSEUM NOVITATES

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DESCRIPTIONS OF FOUR NEW BIRDS FROM THE BELGIAN CONGO¹

BY JAMES P. CHAPIN

This is the fifth preliminary paper on the ornithological results of the Congo Expedition of the American Museum and consists of descriptions of four new forms from the Ituri and Upper Uele Districts of the Belgian Congo. The special color-names employed are taken from Ridgway's 'Color Standards and Color Nomenclature' (1912).

I am obliged to the Carnegie Museum and the courtesy of Mr. W. E. Clyde Todd for the loan of specimens for comparison; and permission has been kindly granted me to examine other material in the U. S. National Museum and the Philadelphia Academy of Natural Sciences.

Astur toussenellii canescens, new subspecies

SUBSPECIFIC CHARACTERS.—Differs from *A. t. toussenellii* (Verreaux) in being slightly larger and much paler, especially below. Easily distinguished by its pale gray, instead of rufous, thighs.

TYPE.—No. 157743, A. M. N. H., ♀ ad., Medje, in northern Ituri District, Belgian Congo, June 28, 1910.

ADULT FEMALE (type).—Crown deep gull-gray, shading gradually to slate-gray on the back; slate-color on the wing-coverts, and dark neutral gray on the outer webs of primaries and secondaries. Primaries beneath light gray with narrow bars of brownish black, on the secondaries these bars disappear, and the color becomes gray fading to white on the basal half of inner webs. Under wing-coverts white, irregularly marked with gray. Rump like the back, upper tail-coverts slightly darker, and median rectrices slate-black, with three large spots of white on the inner web, and a white tip. The outermost tail-feather, about 30 mm. shorter than the middle, is blackish brown, almost uniform, but whitish at the very base on inner web, the remaining feathers have three broad bars of black, with three lighter bars, white on inner web, and a whitish tip. The gray of the crown becomes lighter and bluer on the cheeks, shading to pale gull-gray on the throat; whole of breast and flanks uniform orange-cinnamon, shading to grayish white on abdomen; under tail-coverts white. Thighs pale gull-gray, a few of the feathers with a very slight vinaceous wash. Iris bright orange; eyelids, lores, and cere, yellow; bill horn-blue, with tip black; feet yellow, claws black.

Length (skin), 428 mm.; wing, 234; tail, 203; bill (culmen from cere), 20, (including cere), 27; metatarsus, 65; middle toe with claw, 54.

¹Scientific Results of the American Museum Congo Expedition. Ornithology, No. 5.

ADULT MALE.—No. 157741, A. M. N. H., Avakubi, Ituri, January 20, 1914. Smaller, and more brightly colored on the breast, but thighs likewise pale gray. Iris bright reddish orange. Wing, 199 mm.; tail, 173; bill (from cere), 15, (from base), 22; metatarsus, 57.

IMMATURE BIRDS, from Ituri District, are blackish brown above, white below with dark spots and bars at sides, but unmarked on throat and middle of breast.

Specimens Examined—*Astur t. canescens*. Belgian Congo, Ituri: Avakubi, 1 ♂ ad., 1 ♀ ad., 1 ♀ im.; Medje, 1 ♀ ad.; Uele: Niangara, 1 ♀ im.

Astur t. toussenellii. Gaboon: Fernand Vaz, 1 ♀ ad. Also Plate VI, Cat. Birds Brit. Mus., I, 1874.

Astur sparsimfasciatus. Belgian Congo, Uele District: Aba, 1 ♀ ad.; Faradje, 1 ♀ im.

Astur castanilius. Belgian Congo, Ituri District: Gamangui, 1 ♂ ad.; Medje, 2 ♀ ♀ im.

Astur toussenellii canescens is widely distributed in the Ituri Forest, replacing *A. t. toussenellii* of the forested regions further west. It ranges northward at least to Niangara in the Uele District.

***Colius nigricollis leucophthalmus*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Colius nigricollis nigricollis*, but the hind neck and upper back barred with dark brown, and iris white instead of brown.

TYPE.—No. 158840, A. M. N. H., ♂ ad., Niangara, Uele District, Belgian Congo, November 16, 1910.

ADULT MALE (type).—Forehead, lores, and chin black; crown, crest and ear-coverts vinaceous-buff (Ridgway); hind-neck and upper back light drab, finely barred with dark brown; scapulars, wing-coverts and outer surface of remiges olive-brown; rump slightly lighter, with a few indistinct bars; upper tail-coverts still lighter brown, with distinct blackish bars. Rectrices olive-brown, the two small outer pairs with broad white exterior margins. Throat black in middle, each feather with a gray central spot; these spots growing larger laterally and posteriorly so that the sides of the throat become light gray barred with dusky, the chest drab-gray barred with dark brown. The color of the underparts shades gradually to a uniform cinnamon-buff on belly and thighs, the breast and sides of body being vinaceous-buff barred with brown. Bases of remiges from below cacao-brown, greater wing-coverts similar, but marginals duller and paler. Iris grayish white; rim of eyelids and skin at base of maxilla black, naked areas behind eye light blue; maxilla black with a spot of bluish gray on basal half of culmen; mandible pale buff, but black at sides of base; feet scarlet, claws black.

Length (skin), 310 mm.; wing, 92; tail, 209; exposed culmen, 14; metatarsus, 21.5; middle toe with claw, 26.

There is no appreciable difference between the sexes in color or size. Eighteen males of *C. n. leucophthalmus* measure as follows: Wing, 87–96 (93.1)¹; tail, 179–221 (202.8); exposed culmen, 12.5–14 (13.3); metatarsus, 21–24 (21.9).

¹Averages in parentheses.

Six females of *C. n. leucophthalmus* measure: Wing, 86–97 (93); tail, 184–226 (208.4); exposed culmen, 13–14 (13.1); metatarsus, 21–23 (22).

Five specimens of *C. n. nigricollis* from Leopoldville and Boma, Lower Congo, including both sexes, measure: Wing, 92–99 (95.2); tail, 190–206 (198.6); exposed culmen, 13–14 (13.2); metatarsus, 21–23 (22.2).

SPECIMENS EXAMINED.—*Colius nigricollis nigricollis*. Lower Congo: Boma, 1 ♂ ad., 2 ♀ ♀ ad.; Leopoldville, 2 ♂ ♂ ad. Cameroon: Bitye, River Ja, 1 ♂ ad., 1 ♀ ad.; Lolodorf, 7 ♂ ♂ ad., 6 ♀ ♀ ad., 1 juv. Also Pl. 259, Levillant, 'Oiseaux d'Afrique,' VI, 1808.

Colius nigricollis leucophthalmus.—Belgian Congo, Ituri: Bafwabaka, 4 ♂ ♂ ad.; Medje, 6 ♂ ♂ ad., 3 ♀ ♀ ad., 2 ♂ ♂ juv., 4 ♀ ♀ juv.; Uele: Niangara, 2 ♂ ♂ ad.; 4 ♀ ♀ ad.; Vankerekhovenville, 3 ♂ ♂ ad., 2 ♀ ♀ ad.; Faradje, 3 ♂ ♂ ad.; Garamba, 1 ♀ juv.

Colius striatus striatus.—South Africa: Natal, 5 ad.

The type locality of *Colius nigricollis* Vieillot is Malimbe, in the Portuguese Congo,¹ on the southern edge of the West African forest. Not only is this black-throated Coly known from the adjoining Lower Congo District, but there are many published records from the Cameroon, mostly north of the forest, from the Shari River, and even from the Uele District, the Upper Ituri, and Lake Kivu. Selater and Mackworth-Praed² have identified as *C. striatus nigricollis* specimens from Mt. Baginzi, Meridi, and Kojali in the Bahr-el-Ghazal Province. The range of these Colies extends around rather than through the Congo forests, though they are found in clearings in the Gaboon and Southern Cameroon; and the form occurring to the northeast, in the Upper Uele District, differs markedly from *C. n. nigricollis* as found near the type locality.

Five adult specimens were collected by the American Museum Congo Expedition at Leopoldville and Boma, on the Lower Congo, in 1909 and 1915. In the four cases where the color of the eye was noted it was always dark brown. Reichenow³ and L. Petit⁴ likewise describe the eye as brown, but Levillant stated that he did not know its color.

In adult birds from the northern Ituri and the Uele District, of which we collected a much larger number, the iris is invariably white or grayish white, and this is well shown in the photograph from life (Fig. 1). Only in young birds is it grayish brown. The colors of the bill and naked skin of the face appear to be identical in the two forms.

¹Levant, 1808, 'Oiseaux d'Afrique,' VI, Pl. cclix, and Vieillot, 1817, 'Nouv. Dict. d'Hist. Nat.,' VII, p. 378.

²Ibis, 1919, p. 650.

³1903, 'Vögel Afrikas,' II, p. 204.

⁴1899, Mém. Soc. Zool. France, XII, p. 68.



Fig. 1. *Colius nigricollis leucophthalmus*, ♂ ad., Niangara, Uele District, Belgian Congo, December 3, 1910.

Photograph by H. Lang, from life, showing white iris.

There is also a conspicuous difference in plumage between specimens from the Lower Congo and those from the Ituri and Uele. Typical *C. nigricollis* has the hind-neck and back of a uniform brown, as is clearly stated by both Levaillant and Vieillot, the original description¹ reading: "le dessus du cou et le manteau d'un brun uniforme, plus foncé sur les ailes; les côtés du cou, la poitrine, et les flancs du même brun, et rayés transversalement d'un noir lavé." There may, indeed, be faint indications of barring, but these are due to the structure of the feather rather than to pigmentation.

The birds from the Uele and Ituri are usually more heavily barred on the breast, and this fine barring always extends around on the hind neck and upper back. They are not *C. n. nigriscapalis* Reichenow, for they agree with *C. n. nigricollis* in the color of head and under wing-coverts.

¹1817, 'Nouv. Dict. d'Hist. Nat.', VII, p. 378.

Of *Colius n. nigricollis* from the Cameroon I have examined two specimens in the Philadelphia Academy from the River Ja (G. L. Bates), and thirteen adult specimens from Lolodorf (J. A. Reis), loaned me by the Carnegie Museum. The color of the iris was noted by Bates as grayish brown (♂) and brown (♀), and by Reis in one case as chestnut-brown (♂). With regard to plumage, these birds from the Cameroon agree exactly with *C. n. nigricollis* from the Lower Congo.

For the present, the range of *Colius nigricollis leucophthalmus* may be stated as follows: Savannah region of the northeastern Congo Basin, from the Nepoko River northward to the southern border of the Anglo-Egyptian Sudan, and probably extending to the westward along the northern edge of the forest, as well as southward along its eastern border to Lake Kivu.

***Batis ituriensis*, new species**

SPECIFIC CHARACTERS.—Most nearly related to *B. minima* (Verreaux) from the Gaboon, but differs in having a broad, glossy-black breast-band and a distinct white nuchal spot. Smaller than any species of *Batis* except *B. minima* and *B. perkeo* Neumann¹; but the female of the latter has a brown breast-band.

TYPE.—No. 159881, A. M. N. H., ♀ ad., Gamangui, on Nepoko River, Ituri District, Belgian Congo, February 4, 1910.

ADULT FEMALE.—A large white patch at each side of forehead, but lores, fore part of crown, and postocular region pure black. Posterior half of crown grayish black, bordered laterally by a lighter line of mixed gray and white, which does not extend forward to the eye. Feathers of nape white, tipped with gray; back dark gray, scapulars blacker, rump with oval spots of white; upper tail-coverts black. Wings black, with a conspicuous white stripe running from the outer median coverts, across the greater coverts, and down the outer margins of three inner secondaries; under wing-coverts white save at margin of wing, where they become black. Tail black, the outermost feather widely margined with white, the next two with a narrow white edge, and a small white speck at the tips of other feathers. Under surface white, save for a glossy-black breast-band, 8 mm. wide, and blackish mottling at sides of body. Feathers of tibiae black, tipped with white. Iris yellow; bill and feet black.

Length (skin), 85 mm.; wing, 48.5; tail, 30; exposed culmen, 11.5; metatarsus, 14.

SPECIMENS EXAMINED.—*Batis ituriensis*. Belgian Congo, Ituri: Gamangui, 1 ♀ ad.

Batis minima. No specimens available, only descriptions by Verreaux, 1855, *Revue et Magasin de Zoologie*, (2) VIII, p. 219, and by Sharpe, *Ibis*, 1873, p. 169.

Batis minulla. Belgian Congo, Middle Congo: Suata, 1 ♂ ad.

Batis diops O. Grant. 1910, *Trans. Zool. Soc.*, XIX, Pl. xviii, fig. 2.

Batis molitor puella. B. E. Afr.: Guasonarok, N. Guaso Nyiro, 1 ♂ ad.; Kijabe, 1 ♂ im.

¹1907, *Journ. f. Ornith.*, LV, p. 352.

Batis bella nyansæ. Belgian Congo, Uele: Niangara, 3 ♂♂ ad., 2 ♂♂ juv.; Faradje, 3 ♂♂ ad., 2 ♀♀ ad., 2 ♂♂ juv.

Batis bella congoensis. Belgian Congo, Middle Congo: Kwamouth, 1 ♀.

Our single specimen was taken on the border of a clearing in the forest, where no other species of *Batis* was ever observed. Verreaux remarked¹ that *Batis minima* was found in similar situations in the Gaboon. The type of *B. ituriensis* was sexed by me, and I believe that the male and female will prove to be similar in coloration, as they are in *B. diops*. Inasmuch as the male of *minima* is described by both Verreaux and Sharpe as having a grayish-black band across the breast, the present specimen cannot be referred to that species, in spite of its agreement in size. Moreover, the type localities are approximately 1200 miles apart and no specimens of *B. minima* have ever been taken in the intervening territory.

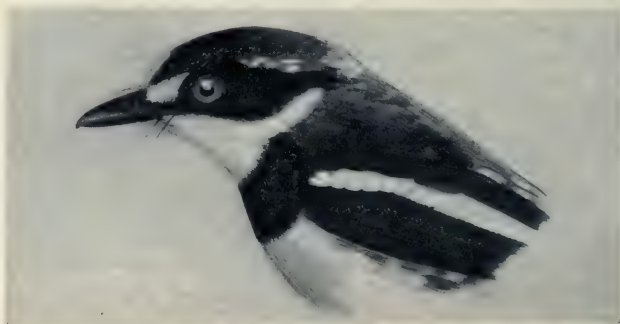


Fig. 2. *Batis ituriensis*, ♀ ad.
Natural size.

***Terpsiphone batesi*, new species**

SPECIFIC CHARACTERS.—Resembling *T. rufocinerea* Cabanis, with a similar, slightly marked crest but always short-tailed, even in the adult male, where the middle pair of rectrices exceeds the second pair by 14.5 mm. at most, on an average by only 8.9 mm. The head is lighter gray, the back brighter rufous than in *rufocinerea*.

TYPE.—No. 160095, A. M. N. H., ♂ ad., Medje, northern Ituri District, Belgian Congo, March 31, 1910.

ADULT MALE (type).—Back, wing-coverts, inner secondaries, outer edges of all remiges, rump and all feathers of tail bright burnt sienna; under tail-coverts bright orange-rufous. Whole head, throat, and hind neck slate-color, with a noticeably

¹1855, Revue et Magasin de Zoologie, (2) VIII, p. 219.

bluer sheen on feathers of crest, which is rather short and rounded, the longest feathers measuring 11.5 mm. Breast, flanks, and abdomen slate-gray, feathers immediately around vent whitish. Inner webs of remiges brownish black, bordered basally with rufous; under wing-coverts largely gray, but longer ones whitish, and the greater coverts with a slight rufous tinge.

Iris dark brown; rim of eyelids slightly expanded, and blue; bill blue with black tip; feet grayish blue.

Length (skin), 175 mm.; wing, 74.5; tail (middle feathers), 94.5, (next pair), 80, (outermost), 65.5; exposed culmen, 14; metatarsus, 15.

Measurements of six adult males are as follows: Wing, 73–77 (74.9)¹; tail (middle feathers), 78–94.5 (88), (next pair), 75–83.5 (79.1); exposed culmen, 12.5–14 (13.5); metatarsus, 14–15.5 (14.9).

ADULT FEMALE.—Somewhat duller and paler, crest without gloss, back Sanford's brown, middle of abdomen paler gray. Dimensions of three adult females are: Wing, 72–73.5; tail (middle feathers), 73.5–75, (next pair), 71; exposed culmen, 12–13; metatarsus, 14–15.5.

SPECIMENS EXAMINED.—*Terpsiphone batesi*. Belgian Congo, Distr. of Stanleyville: Bafwasende, 1 ♂ ad.; Ituri: Avakubi, 3 ♂ ♂ ad.; Bafwabaka, 1 ♂ ad., 2 ♀ ♀ ad.; Medje, 1 ♂ ad., 2 ♀ ♀ ad. Cameroon: Bitye, ♂ 1 ad., 1 ♀ ad.; Assobam, 1 ♂ ad.

Terpsiphone rufocinerea. Belgian Congo, Lower Congo: Boma, 2 ♂ ♂ ad., 2 ♂ ♂ im., 1 ♀ im. Spanish Guinea: Rio Muni, 2 ♂ ♂ ad. Gaboon: Rio Moondah, 1 ♂ ad., 1 ♀.

Terpsiphone plumbeiceps. Belgian Congo, Distr. of Stanleyville: Bengamisa, 1 ♂ ad.; Uele: Vankerckhovenville, 1 ♂ ad. Nyassaland: Zomba, 1 ♂.

Terpsiphone batesi is a common and characteristic bird of the Ituri Forest, at least from Bafwasende on the River Lindi and Avakubi on the Ituri northward to Medje and the River Nava. It associates with *T. ignea* in the mixed flocks of insectivorous birds that wander through these shady solitudes; but does not venture forth into clearings around villages. Eastward, it extends to Ukaika and between Mawambi and Irumu, whence Sassi reports specimens collected by Grauer² under the name of *T. rufocinerea*. Westward, it reaches at least to Bitye on the River Ja, South Cameroon, as proved by two specimens in the Philadelphia Academy of Natural Sciences, collected by G. L. Bates and labeled also as *T. rufocinerea*.

Among the many names proposed for species of *Terpsiphone*, only *rufocinerea* has ever been applied to this one, and I therefore take pleasure in naming it in honor of Mr. G. L. Bates, who has made such invaluable contributions to African ornithology.

T. rufocinerea was described by Cabanis³ from Chinchoxo, Loango Coast, and I have collected specimens not very far away, at Boma, on

¹Averages in parentheses.

²1916, Ann. K. K. Naturhist. Hofmus., XXX, p. 258.

³1875, Journ. für Ornithologie, p. 236.

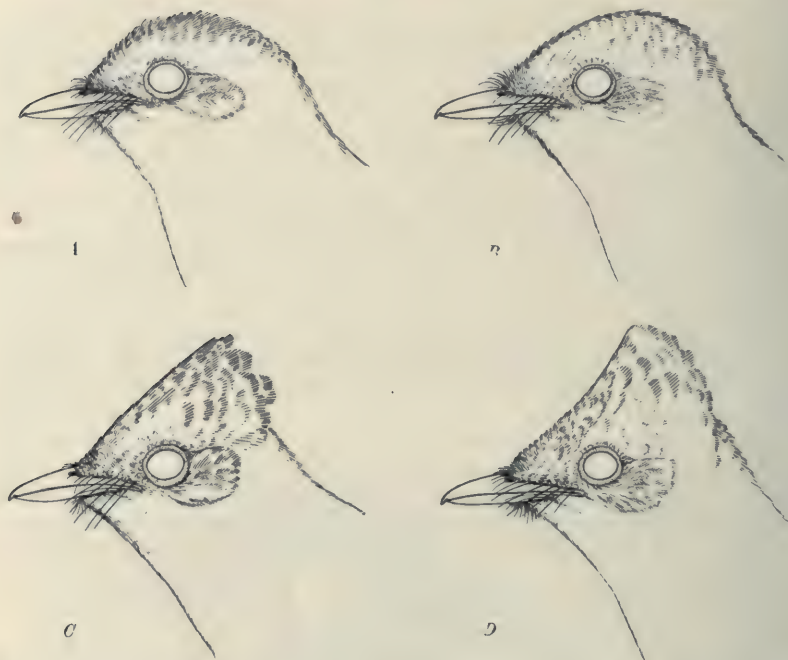


Fig. 3. Heads of adult males in four species of *Terpsiphone*, showing form of crest.

A.—*T. rufocinerea*. B.—*T. batesi*. C.—*T. plumbeiceps*. D.—*T. viridis*. $\times \frac{1}{2}$.

the Lower Congo. The latter agree with the original description in every respect, and one of Cabanis' two types is stated to have had the middle rectrices greatly lengthened, as they are in my adult males. In the collection of the Philadelphia Academy there are likewise four specimens of *T. rufocinerea* from the Du Chaillu Collection, taken at Rio Moonda, on the west coast. Two of these have long rufous tail-feathers, and one is remarkable in having several greater wing-coverts on both sides black, bordered with white.

Our nine adult specimens of *T. batesi* and the three I have examined from the Cameroon show a striking uniformity in their distinctive characters.

From *T. plumbeiceps* the species here described as new may be known by its shorter crest, bright rufous under tail-coverts, and short tail. It differs from *T. schubotzi*, if Prof. Reichenow's description¹ is

¹1911, Orn. Monatsberichte, XIX, p. 82.

exact, in its bluish gray breast, and from the recently described *T. poliothorax* Reichenow¹ in having the head grayish, not black, and abdomen gray, not rufous.

It bears some resemblance to females and young of *T. perspicillata* and *T. viridis*, but is at once separable by its much brighter rufous back and paler head with more rounded crest. The form of the crest in the different species of *Terpsiphone* is very characteristic, and Figure 3 shows its general outline in four of the species here mentioned.

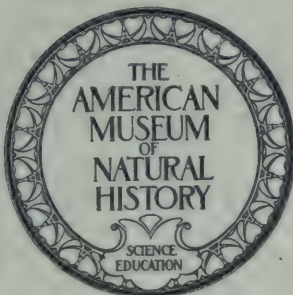
¹1916, Journ. für Ornithologie, LXIV, p. 161.

AMERICAN MUSEUM NOVITATES

No. 8

POLYCHÆTOUS ANNELIDS COLLECTED AT
ST. PAUL DE LAONDA BY THE AMERICAN
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By A. L. TREADWELL



Issued June 3, 1921



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POLYCHÆTOUS ANNELIDS COLLECTED AT ST. PAUL DE LOANDA BY THE AMERICAN MUSEUM BELGIAN CONGO EXPEDITION¹

BY A. L. TREADWELL

Several families of polychæτους annelids are represented in the collection.

The Nereidæ are *Nereis pelagica* Linnæus and *N. tongatabuensis* McIntosh.

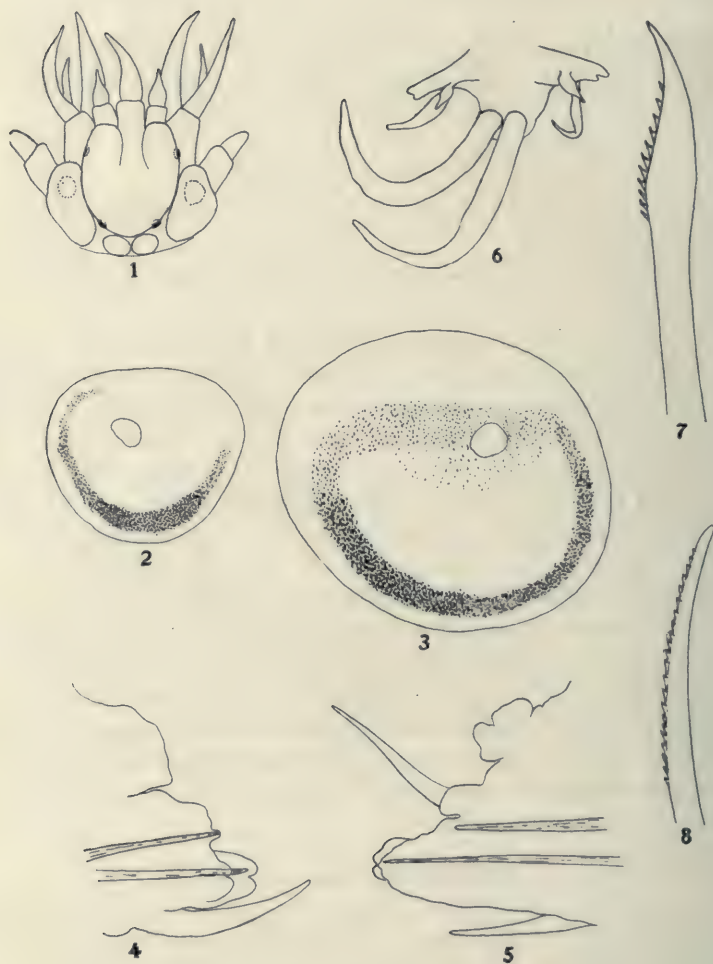
Of the Leodicidæ, *Diopatra neapolitana* Delle Chiaje is represented by a single specimen, and there is a fragment of a tube of some leodicid. There are a few fragments of *Chætopterus*, too much injured for identification, and a considerable number of specimens of *Dasychonopsis* (*Dasychone*) *bairdii* McIntosh. The appearance of this last species is unexpected, since it was first described from the West Indies, but it is evident that a sessile species like this might be easily transported on the bottom of ships.

Of the Polynoidæ there are several specimens of *Lepidonotus clava* Montagu, and a single mutilated specimen of a *Harmothoë*, apparently closely related to *H. fraser-thomsoni* of McIntosh ('Monograph of the British Annelids,' Pt. II, 'Polychætes.' Ray Society, 1900, p. 337), but the elytra lack the large tubercles found on one side only, which McIntosh describes from that species. The appendages of the head were entirely lost and close comparisons are not possible. A species of *Acholoë* is new and its description follows.

***Acholoë orbiculata*, new species**

The animals were all very much coiled in a close spiral, which made counting of the somites and exact determination of the length difficult. So far as I could determine, the body is about 50 mm. long, and the average specimen has a prostomial width of 0.5 mm. There are 45 or 46 elytra covering the entire dorsal surface of the body to the extreme posterior end. In the preserved material the elytra have a ground color of a pearly white, with pigment over the elyrophore in a somewhat diffuse patch, while from this patch a narrower and much more sharply defined band extends around the elytron, leaving the margin uncolored. In the entire animal the diffuse part of the pigment is covered in each elytron by the overlapping of the one anterior to it, so that the most striking feature is the succession of ringed elytra. In the first elytron the diffuse patch around the elyrophore does not occur.

¹Scientific Results of the American Museum Congo Expedition. General Invertebrate Zoology, No. 7.



Figs. 1 to 8. *Acholoë orbiculata*, new species.

- Fig. 1. Anterior end, $\times 22.5$.
 Fig. 2. First elytron, $\times 22.5$.
 Fig. 3. Posterior elytron, $\times 22.5$.
 Fig. 4. First parapodium, $\times 45$.
 Fig. 5. Later parapodium, $\times 22.5$.
 Fig. 6. Anal cirri, $\times 45$.
 Fig. 7. Ventral seta, $\times 185$.
 Fig. 8. Dorsal seta, $\times 185$.

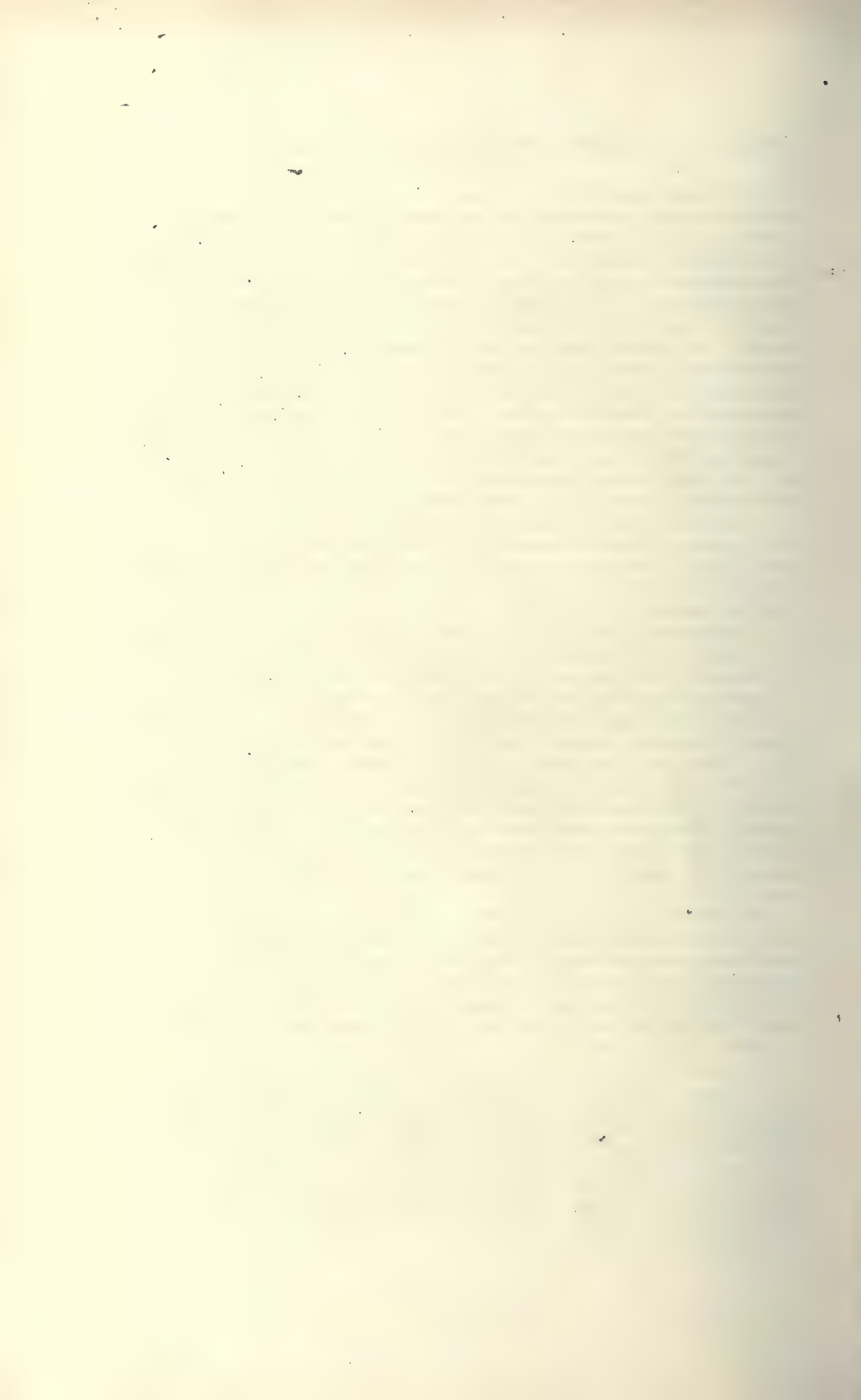
The prostomium (Fig. 1) is oval in outline, a little longer than broad, and with the anterior margin on either side rounded instead of being prolonged into peaks. The median tentacle is carried on a large cirrophore, which is inserted in the front of the prostomium, its terminal joint being only about twice as long as the cirrophore, tapering gradually to an acute point. The cirrophores of the lateral tentacles apparently arise on the level of the margin of the prostomium, but are really very slightly below it. The cirrophore is about as long as the terminal joint, which is acutely conical. The palps are rather slender, extending beyond the tentacles. The dorsal tentacular cirrus is larger than the ventral and extends about to the apex of the palp. Both palps and tentacular cirri have a few colorless papillae, visible only under a magnification of 75 to 100 diameters. The large first elytriphores bound the prostomium postero-laterally and there are two pairs of eyes, one pair at the posterior margin, and the other pair toward the anterior end. From a dorsal view, these appear to be very small, though they are really of a moderate size, but lie far enough under the curve of the prostomium to be partly hidden from the dorsal view.

Dorsal cirri (Fig. 5) are long and slender. There is one pair of anal cirri, rather stout processes, arising from the ventral surface of the pygidium (Fig. 6). The first elytron (Fig. 2) differs from later ones (Fig. 3) only in size and in the lack of the diffuse pigmentation around the elytriphore. All elytra have smooth margins and no trace of surface papillae.

The first parapodium (Fig. 4) has dorsally the elytriphore of the first elytron. The notopodium is smaller than the neuropodium and carries a single acicula and a tuft of setae of the sort shown in Fig. 8. The setal portion of the neuropodium has an anterior and a posterior lip, the former being the larger, with an acicula a trifle larger than the notopodial, and a tuft of setae like those in Fig. 7. The slender ventral cirrus extends beyond the end of the parapodium. A posterior parapodium (Fig. 5, drawn to a scale one half that of Fig. 4) has much the same outline as that of the first, but is much larger, and in the case of cirrus-bearing somites, as is shown in the figure, there is a slender dorsal cirrus, extending beyond the apex of the parapodium. Dorsal to the cirrus, on the body wall, is a fold which was somewhat distorted in outline in the specimen figured, but which, on a surface view of the entire animal, has an outline like that of a hammer head. This is apparently a respiratory organ.¹

The dorsal setae (Fig. 8) are smaller than the ventral, with a bluntly rounded shaft, carrying toward the apex two rows of teeth, each tooth in the form of a narrow plate denticulated on its margin. Only one of these rows of teeth can be seen in the profile view shown in the figure. The ventral setae (Fig. 7) are much larger with their shafts heavier, and enlarged near the apex. Along this enlarged portion, extend two rows of teeth like those on the dorsal setae. As in the latter case only one row appears in profile.

¹The presence of processes like these led Grube (1855, 'Beschreibung neuer oder wenig bekannter Anneliden,' Wiegman, 'Archiv. f. Naturgesch., I, p. 81) to describe as *Polynoë malleata* a form from Trieste. McIntosh has later (1900, 'Monograph of the British Annelids,' Pt. II, Ray Society, p. 397) identified this with Clapere'de's *Acholoë astericola*, a form apparently closely related to *A. orbiculata*, but differing from it in the character of the elytra. In his diagnosis of the genus *Acholoë*, McIntosh (*loc. cit.*, p. 396) states that the dorsal cirri occur on every foot, but in his description of *A. astericola* he says that the T-shaped lobes occur in the cirriferous feet. In *A. orbiculata* I find that, as is the rule, elytron-bearing somites alternate with cirriferous ones. Grube's original description of *Polynoë malleata* stated that there are 39 elytra, while McIntosh gives 45 as the number in *A. astericola*, but the latter author regards the two as synonymous. The arrangement of setae is the same in the posterior as in the anterior somites, and there is a slender ventral cirrus, not differing much in outline from the anterior ones, but very much shorter.

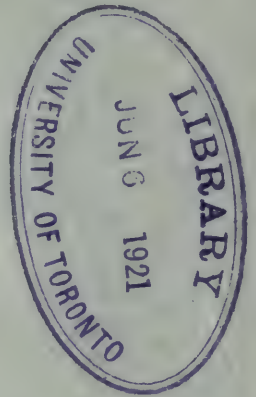
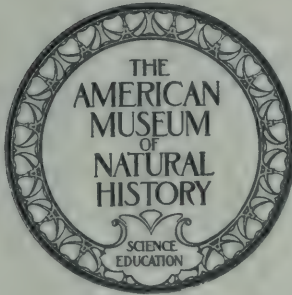


AMERICAN MUSEUM NOVITATES

No. 9

A REMARKABLE CASE OF EXTERNAL HIND LIMBS IN A HUMPBACK WHALE

By ROY CHAPMAN ANDREWS



Issued June 3, 1921

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A REMARKABLE CASE OF EXTERNAL HIND LIMBS IN A HUMPBACK WHALE

By ROY CHAPMAN ANDREWS

In July 1919, a female Humpback Whale (*Megaptera nodosa*) with two remarkable protrusions on the ventral side of the body, posteriorly, was captured by a ship operating from the whaling station at Kyuquot, on the west coast of Vancouver Island, British Columbia.



Fig. 1. Caudal part of the whale, showing the hind limb *in situ*.

One of the protrusions was cut off by the crew of the vessel but the other was photographed *in situ* by the superintendent of the Station. Mr. Sidney Ruck and Mr. Lawson, officials of the Consolidated Whaling Company, appreciated the importance of the discovery and presented the skeletal remains of the attachment to the Provincial Museum, Victoria, B. C.

At my request, Mr. Francis Kermode, Director of the Provincial Museum, very courteously submitted the bones to me with permission to publish upon the result of my examination.

Under date of March 4, 1920, Mr. Ruck writes to Mr. Kermode as follows:

I enclose herewith three photographs showing the unusual development of the pelvic Rudiments in a whale captured at the Kyuquot Station last July, of which you have the bones. It is to be regretted that better pictures in evidence of this unprecedented development were not obtained.

I have been connected with the Whaling Industry for 22 years and during my time have come in contact with prominent Naturalists such as Professor True of the Smithsonian Institute, Professor Lucas of the Natural History Museum, Brooklyn,¹ and Professor Andrews of the Natural History Museum, New York, and neither in their experience or mine have the protrusion of the pelvic bones beyond the body ever been seen or heard of.

This particular whale was a female humpback of the average length with elementary legs protruding from the body about 4 feet 2 inches, covered with blubber about one-half an inch thick.

As shown in the best photograph these legs protruded on either side of the genital opening; the left leg was cut off by the crew of the vessel and lost, and the point at which it was cut off is clearly shown in the photograph. The end of the leg seen in the picture terminated in a kind of round knob like a man's clenched fist.

The two bones of the leg which you have are connected by cartilage which I was informed had shrunk about 10 inches, and possibly more by this time. At any rate the total length of the leg before it was cleaned of the blubber and flesh was, as before stated, about 4 feet, 2 inches, from the body.

After studying the material and discussing it with various scientists, I have come to the conclusion that the protrusions actually do represent vestigial hind limbs and show a remarkable reversion to the primitive quadripedal condition.

I am well aware that zoologists are inclined to accept reported instances of reversion with extreme reluctance and that, at first sight, the tendency will be to consider this a teratological case of no reversionary significance, but the evidence is so strong that I can not interpret it in that way.

Mr. Ruck reports that the total length of the leg "before it was cleaned of the blubber and flesh" was about four feet and two inches. The skeletal remains in my possession consist of two bones and two heavy cartilages. When placed in position as in Fig. 2, the total length is 31 inches.

¹Then of the U. S. National Museum, now of The American Museum of Natural History.



Fig. 2. Skeleton of the hind limb.
Fig. 3. Cartilaginous femur and osseous tibia.
Fig. 4. Cartilaginous tarsus and osseous metatarsal.

FEMUR.—The larger bone is deeply concave proximally and to it is attached a massive cartilage (Fig. 3) which, in its present shrunken condition, is $5\frac{1}{4}$ inches in length and $1\frac{5}{8}$ inches wide. I estimate that this cartilage was at least 15 inches long and 3 inches wide when fresh. I believe that this cartilage represents the femur. It probably lay entirely within the body, its proximal end being attached to the pelvic vestiges. Such a massive cartilage must necessarily have had a firm support and leads me to believe that the pelvic elements in this individual were of extraordinary size. The pelvic bones, as usually present in the *Megaptera*, are slender ossifications about 6 or 8 inches in length and would not furnish a firm enough base for the attachment of a cartilage which, in its fresh condition, was as large as a man's wrist.

Since the photograph of the limbs *in situ* shows that they were directly below the usual location of the pelvic vestiges and since there are no other "floating" bones near this region, the conclusion that they were attached to the pelvic elements is entirely justifiable.

TIBIA.—The larger of the two bones I identify as the tibia (Fig. 3). It is $14\frac{1}{4}$ inches in greatest length, is well developed, and has a hard, smooth outer surface. At the proximal end its greatest width is $3\frac{3}{4}$ inches, it narrows gradually for three-fourths of its length, and then suddenly expands at the distal extremity, where it is $2\frac{1}{2}$ inches wide.

TARSUS.—The distal end of the tibia is convex and gives attachment to a cartilage which in its shrunken state is $4\frac{3}{4}$ inches long and $1\frac{3}{4}$ inches wide (Fig. 4). This cartilage, I believe, represents the tarsus. That it presents no ossifications is by no means surprising as the carpal bones in the fore limbs of cetaceans are sometimes entirely absent and often in a more or less rudimentary condition. Mr. Ruck says "the two bones of the leg which you have are connected by cartilage which I was informed had shrunk about 10 inches and possibly more by this time." This would give the tarsal cartilage a length of nearly 15 inches.

METATARSAL.—The distal element in the leg is a hard, well-developed bone which I identify as a metatarsal (Fig. 4). It has the characteristic shape of the metacarpals in the fore limbs of cetaceans except that it is more slender. It is $6\frac{7}{8}$ inches long, $1\frac{7}{8}$ inches wide proximally, and $1\frac{1}{8}$ inches in distal width; its least width is $\frac{15}{16}$ of an inch. To the distal end of the metatarsal is attached a heavy cartilage of which only $\frac{3}{4}$ of an inch remains intact. This cartilage probably formed the extremity of the limb skeleton.

EXTERNAL APPEARANCE OF THE LIMB.—In reference to the limb as it appeared in the fresh condition, Mr. Ruck says that the end terminated in a "kind of round knob like a man's clenched fist," that the total length was about four feet and two inches, and that it was covered with blubber about one-half inch thick. I infer from Mr. Ruck's description that the connective tissue and blubber were essentially the same as in the flipper, or fore limb, of cetaceans. The photograph of the limb *in situ* (Fig. 1) show that there are two prominent, truncated tuberosities on the distal half. The proximal "bunch" evidently indicates the distal end of the tibia and the other is at the extremity of the metatarsal. These tuberosities may very properly be homologized with those on the outer, or anterior, edge of the flipper in the *Megaptera* which indicate the extremities of the radius and the second digit. This is, I believe, a point which has considerable significance.

Since the stalk-like cartilaginous femur probably lay entirely within the body and the remainder of the limb entirely outside, there was undoubtedly a certain flexibility at the point of junction with the body.

In a paper entitled 'Untersuchungen an walen,'¹ Professor W. Kükenthal has described external rudimentary hind limbs in three early embryos of *Megaptera*. These appear as two more or less caudally directed papillæ on either side of the genital organ in the same relative position as the hind limbs which I have described in this paper. In Kükenthal's Stage I (an embryo 32 mm. in length) the rudiments are best developed and are 12 mm. long. In Stage II (an embryo 28 mm. long) the rudiments are somewhat less distinct, reaching a length of 9 mm. In Stage III (an embryo 30 mm. long) the hind-limb rudiments have still more decreased in size and appear as minute papillæ.

Kükenthal has also discovered hind-limb rudiments in embryos of *Phocæna communis* and *P. dalli*, and Guldberg has recorded them in embryos of *Lagenorhynchus acutus* and *Phocæna communis*.

Kükenthal states that the hind-limb rudiments are found in later embryonic stages of the *Mystacoceti* than in the *Odontoceti* and concludes that in the evolution of cetaceans the hind limbs lost their functional character in the *Odontoceti* earlier than in the *Mystacoceti*.

Since Kükenthal's and Guldberg's researches have shown that external hind-limb rudiments are still present in some cases in embryonic life, it is by no means impossible that, these vestigial organs should continue their growth and persist until the adult stage. I believe that

¹Jenaische Zeitschrift für Naturwissenschaft, LI, 1914, pp. 49-52.

that is exactly what has occurred in the specimen which I have described above, and that we are confronted with a clear case of partial reversion to a primitive quadripedal condition.

The limbs, according to the statements of the whalers, were symmetrical; they are in the exact position in which the hind-limb rudiments have been found in embryonic *Megaptera*; there are strong indications that the cartilaginous femur was attached to the pelvic elements; they are homologous in many respects to the flippers, or fore limbs, and, were this a teratological case, it is doubtful if these homologies would exist.

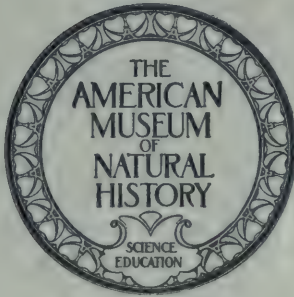
Unwilling as are many evolutionists to accept reported cases of reversion, I can see no other explanation for the facts presented here. That this condition is extremely rare must certainly be true for, so far as I am aware, this is the only recorded case among cetaceans. The presence of rudimentary hind limbs would almost certainly attract the attention of whalers under any condition and eventually be reported to a scientific institution, as was done in the case under consideration. Although hundreds of thousands of whales have been killed, especially in the last fifty years since the beginning of shore-whaling, no other instance has been reported. We are greatly indebted to Mr. Ruck and Mr. Lawson for their quick appreciation of the importance of their discovery and I wish again to express my thanks to Mr. Kermode for giving me the privilege of describing it.

AMERICAN MUSEUM NOVITATES

No. 10

FIRST APPEARANCE OF THE TRUE MASTODON IN AMERICA

BY HENRY FAIRFIELD OSBORN



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FIRST APPEARANCE OF THE TRUE MASTODON IN AMERICA

BY HENRY FAIRFIELD OSBORN

The geologic history of the *Mastodon* is obscure and the geographic distribution uncertain because of its forest-living habits, but recently great progress has been made in tracing the history of this animal in America, especially through the studies and collections by Matthew and Cook¹ and Sinclair,² through Schlesinger's description of the Miocene proboscideans of Europe,³ and finally through Matsumoto's restudy of the proboscideans of the Oligocene Fayûm deposits of northern Egypt.⁴ From the latter it appears probable that the true *Mastodon* sprang from the genus *Palæomastodon* of northern Africa, while the bunomastodonts (*Trilophodon angustidens* phylum) sprang from the genus *Phiomia* of the same deposits. From the American Museum collections hitherto undescribed, Matsumoto has positively separated these genera and the species associated with them, which have been confused ever since the original descriptions by Andrews of *Palæomastodon*, in 1901, and of *Phiomia*, in 1902.

Matsumoto shows that the name *Palæomastodon* applies only to the lophodont type of *P. beadnelli* on which it was founded. This animal has a much broader skull than its contemporary *Phiomia*. These two animals were profoundly distinct, but, until the remainder of the skull and cutting teeth of *P. beadnelli* is known, we cannot be sure that this animal is directly ancestral to *Mastodon*.

MIOCENE AND PLIOCENE MASTODONS IN EUROPE

To the *M. tapiroides* of Cuvier, Schlesinger has added a series of forms which are more or less truly lophodont from the Miocene of France and of Austria, the relations of certain of which to *Mastodon* are, in our

¹'A Pliocene Fauna from Western Nebraska.' By W. D. Matthew and Harold J. Cook, 1909, Bull. Amer. Mus. Nat. Hist., XXVI, Art. 27, pp. 361-414.

²'Contributions to the Snake Creek Fauna.' By W. D. Matthew, 1918, Bull. Amer. Mus. Nat. Hist., XXXVIII, Art. 7, pp. 183-229.

³'Additions to the Fauna of the Lower Pliocene Snake Creek Beds (Results of the Princeton University 1914 Expedition to Nebraska).' By William J. Sinclair, 1915, Proc. Amer. Phil. Soc., Phila., LIV, No. 217, May-July, pp. 73-95.

⁴'Die Mastodonten des K. K. Naturhistorischen Hofmuseums.' By Günther Schlesinger, 1917, Denksch. K. K. Naturhist. Hofmuseums, I, Geol.-Paläontol., Reihe 1, pp. 1-230.

⁵In preparation for the American Museum Bulletin by Dr. Hikoshichiro Matsumoto.

opinion, doubtful. There cannot be the least doubt, however, as to the affinity of the grinding teeth found in the Lower Pliocene of Hungary, to which Schlesinger applies the name *M. tapiroides americanus*. These teeth are reproduced herewith (Fig. 1, *D, D1*) from unpublished photographs, kindly forwarded by the author, to the same scale with corresponding grinders (*A, A1, A2, A3*) from the Lower Pliocene, Snake Creek formation, of western Nebraska, also with lower teeth (*B*) from the Middle Pliocene, Thousand Creek, Nevada, and with (*C*) the posterior lower molar of *M. americanus* from the American Pleistocene.

***Mastodon tapiroides americanus* Schlesinger**

The upper and lower grinders from the Lower Pliocene, Tasnád, Usztató Kom., Hungary, embrace a third left superior molar (Fig. 1, *D1*, see Pl. XIII, fig. 5, Schlesinger), also two left inferior molars, m_2 - m_3 (Fig. 1, *D*, see Pl. XIV, fig. 1, Schlesinger). The linear measurement of the crowns agrees closely with that of the Pleistocene *M. americanus*, but the vertical measurement is apparently less, i.e., less hypsodont. This indicates that already in the Lower Pliocene the mastodonts had attained the massive proportions of their Pleistocene descendants. The lophs are similarly composed and show no trace of a trefoil ridge. There is nothing to debar these Lower Pliocene mastodonts of Hungary from the true ancestral line of our Pleistocene *Mastodon*.

THE AMERICAN PLIOCENE MASTODONS

During the summer of 1908 the American Museum party, under Dr. W. D. Matthew, first collected in the Snake Creek of western Nebraska a fauna subsequently determined as of Lower Pliocene age (Matthew and Cook, 1909, p. 361). The first proboscidean found appeared not to be referable to the true *Mastodon* (p. 367) but rather to the bunomastodont group. Subsequently, in 1918, several distinctive specimens were found in the same beds which may now be named as the type and paratypes of a new species of *Mastodon* (*Mastodon matthewi*), in honor of Dr. W. D. Matthew, the author who first described this interesting fauna. In 1918¹ this fauna was divided by Matthew into two life zones, an older zone of Upper Miocene age, in which *Merychippus* was abundant, and a more recent zone containing *Protohippus*, *Hipparion*, and *Pliohippus* (cf. *mirabilis*) of Lower Pliocene age. The latter zone may be known as

¹Osborn, H. F., 1918, 'Equidae of the Oligocene, Miocene, and Pliocene of North America. Iconographic Type Revision.' Mem. Amer. Mus. Nat. Hist., N.S., II, Pt. I, p. 34, "Preliminary Key to the Geologic Distribution of the Principal Species of Equidae."

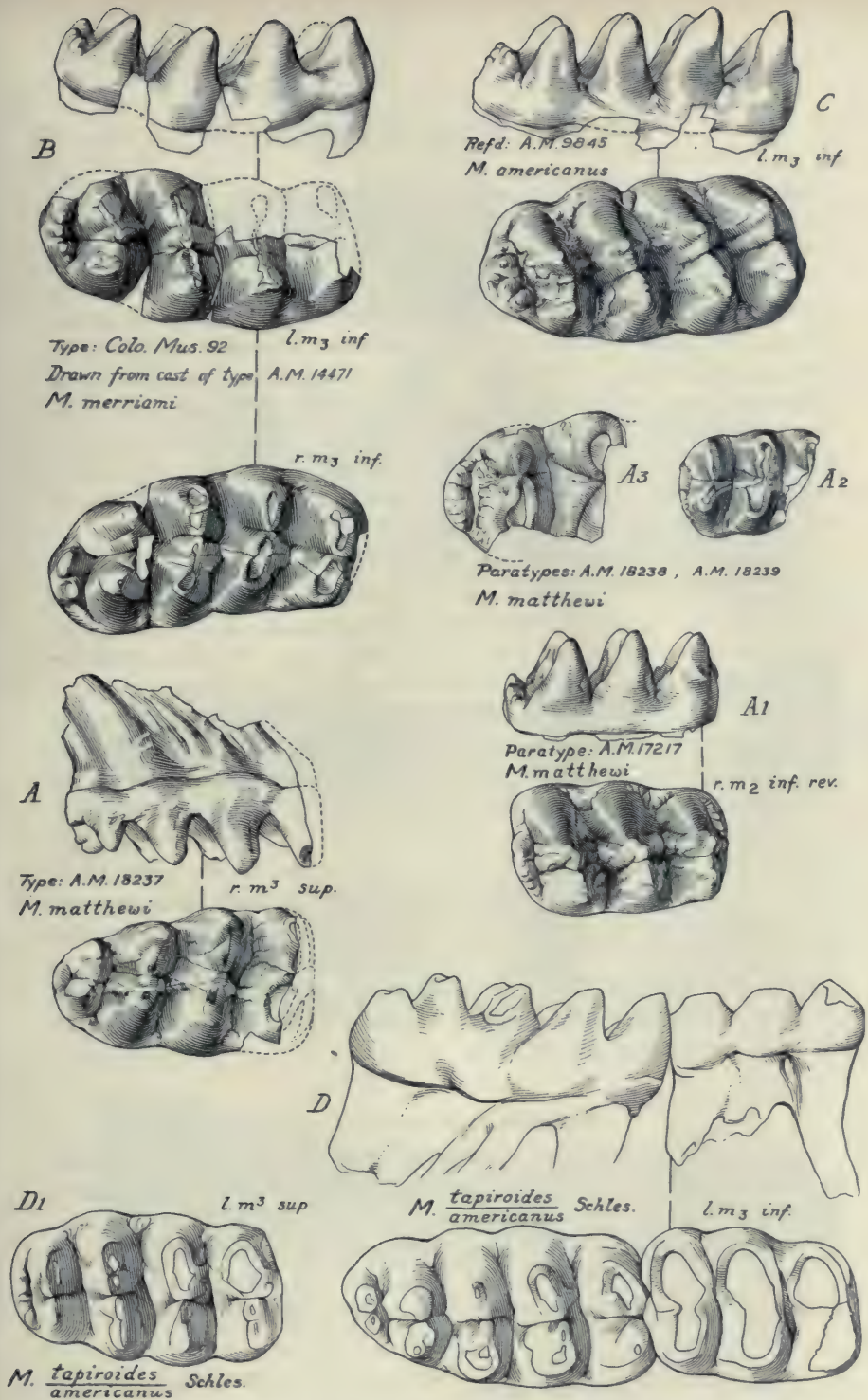


Fig. 1. *D* and *D1*. Inferior molars referred to *Mastodon tapiroides americanus*, from the Lower Pliocene of Hungary. Reproduced through the courtesy of Dr. Günther Schlessinger.

A, *A1*, *A2*, and *A3*. Type and paratypes of *Mastodon matthewi* Osborn, from the Lower Pliocene of Nebraska.

B. Type molars of *Mastodon merriami* Osborn, Middle Pliocene of Nevada, *Colo. Mus. 92*.

C. Referred *Mastodon americanus*, from the phosphate beds of South Carolina, in the American Museum.

All figures one-fourth natural size.

Snake Creek B or *Procamelus-Hipparion* Zone, similar to that of Fort Niobrara Nebraska, of Little White River South Dakota, of Clarendon Texas, and of the Santa Fé Marls B New Mexico. From his collection of 1914, Sinclair also reported (1915, p. 84, Fig. 9) a left last lower molar attributed to ?*Mastodon* species, collecting locality 1000A. It is probably in this true early Pliocene of North America, broadly equivalent to Pikermi-Eppelsheim of Europe, that *M. matthewi*, the first true *Mastodon* to reach America, occurs. In his second paper, Matthew (1918, p. 199) confirms Sinclair's division of the Snake Creek proboscideans into two types and selects for the zygalophodont type, allied presumably to *M. americanus*, the generic name *Zygalophodon* Vacek, 1877, type *M. tapiroides* Cuvier.

Of more recent age, probably Middle Pliocene, is the type of *Mastodon merriami* from Thousand Creek, Humboldt County, Nevada, discovered by Mr. George D. Mathewson in digging one of the excavations along the opal outcrop on a precipitous hill about 500 feet above the level of Thousand Creek and between the main forks of the creek, as described by the geologist, Richard C. Hills.¹ The formation consists of a more or less stratified volcanic ash containing much opalized wood. The type specimens include several bone fragments, portions of the two upper tusks, and parts of the upper molars, in addition to the well-preserved two lower molars here figured as the type. A very important character is the presence of broad enamel bands on the upper tusks (Fig. 2, C, D, E), which are perhaps similar to the enamel bands observed by Schlesinger in the true Miocene and Pliocene mastodons of Hungary. The Thousand Creek fauna of Nevada is regarded by Merriam as of Middle Pliocene age. It is deemed by Osborn as belonging to the *Ilingoceras-Pliohippus* Zone, to which is assigned the temporary number 16 (Osborn, 1918, p. 34).

***Mastodon matthewi*, new species**

TYPE: the right third superior molar, Amer. Mus. 18237. PARATYPES: the right second inferior molar (unworn), Amer. Mus. 17217; the posterior portion of a right third inferior molar (more worn), Amer. Mus. 18238, also of a right second inferior molar, Amer. Mus. 18239. The type and paratypes probably belong to four different individuals. Collected by the American Museum expeditions of 1916 and 1918 under

¹The writer is indebted to Dr. Richard C. Hills for a letter, March 9, 1921, which contains a full account of his discovery of this interesting type.

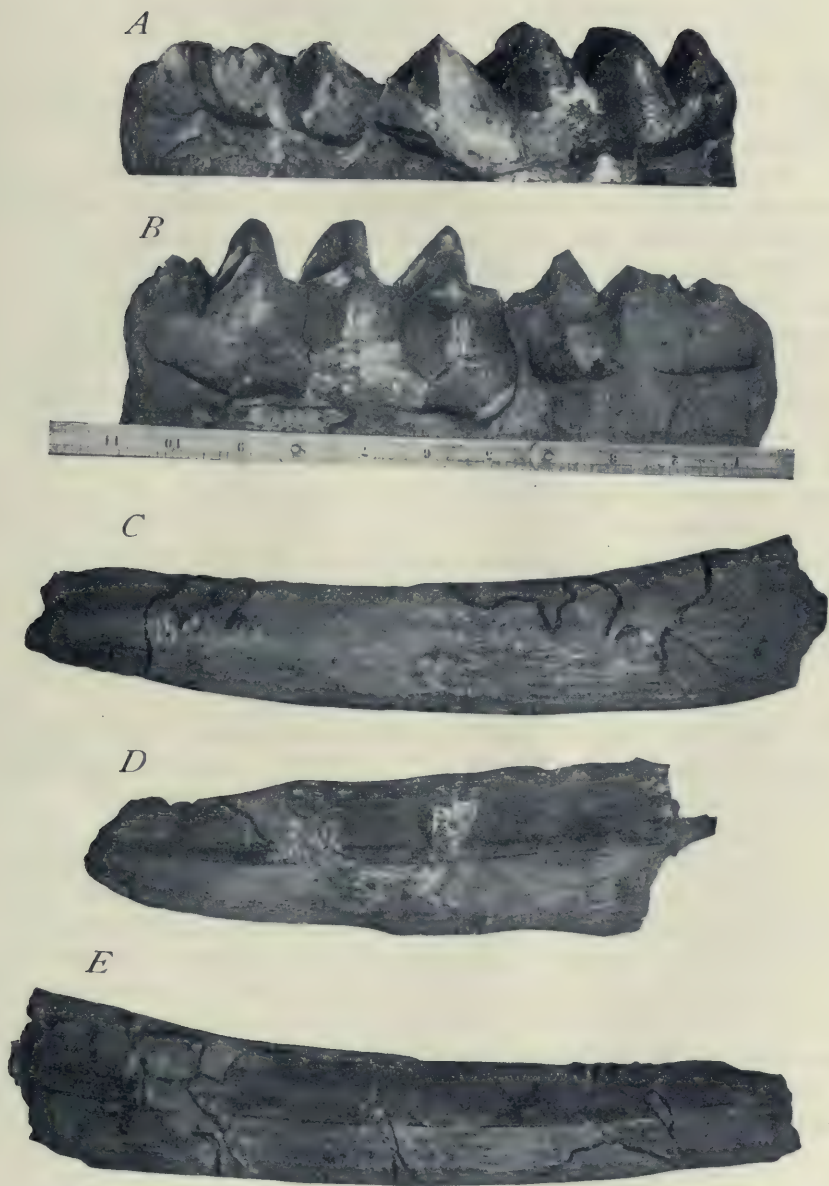


Fig. 2. Type of *Mastodon merriami*, Colo. Mus. 92. See also Fig. 1 B.
 Two lower grinders: A. Internal view. B. External view. Tusk: C. Lateral view. D. External
 view. E. External view of opposite tusk. Inch scale as indicated.

Mr. Albert Thomson. The type and Nos. 18238 and 18239 are from the Snake Creek B level (*Procamelus-Hipparion* Zone) of Sioux County, Nebraska; the level of No. 17217 is not recorded.

The type (Fig. 1, A) is distinguished by the rapid narrowing of the posterior half of the crown of the third upper molar, including the third and fourth crests; the fourth crest is extremely narrow and bilobed; the rudimentary fifth crest consists of a single cusp. In these features *M. matthewi* is more primitive than the corresponding tooth of *M. tapiroides americanus* (Fig. 1, D1) of the Lower Pliocene of Hungary. The association of the lower molars, Amer. Mus. 17217, 18238, 18239, as paratypes is provisional, because the Snake Creek deposition extended over a long period of time and may represent more than two life zones. Of these teeth, m_2 presents three unworn pointed crests with the rudiments of a trefoil (Fig. 1, A1); in a second molar (Fig. 1, A2) the trefoil is less apparent; in the third lower molar (Fig. 1, A3) it is not apparent at all. In the latter tooth, which is probably the posterior half of a third lower molar of the right side, the third and fourth crests are partly preserved; crest five is represented by a broad tuberculate talon.

***Mastodon merriami*, new species**

TYPE: Colo. Mus. 92, found in 1909 in the Thousand Creek formation, Humboldt County, Nevada, includes two left inferior molars (Fig. 2, A, B); cast, Amer. Mus. 14471, also portions of two upper tusks.

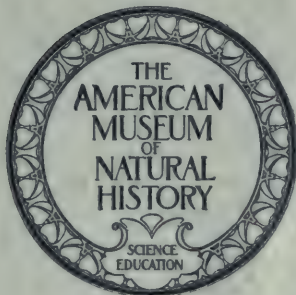
The contours of these grinding teeth, as seen from above (Fig. 1, B), are convexo- (inner side) concave (outer side); the first crest is relatively narrow; the second, third, and fourth crests are relatively broad; the rudimentary fifth crest is little if any more advanced than in *M. matthewi*; crests two to four exhibit rudimentary intermediate cones and the spurs of a trefoil. The presence of an enamel band on the tusks and the somewhat more brachyodont character of the grinding teeth separate this stage from the *M. americanus* (Fig. 1, C) of the Pleistocene. This species is dedicated to Professor John C. Merriam, in recognition of his pioneer work in describing the fauna of Thousand Creek.

AMERICAN MUSEUM NOVITATES

No. 11

THE GEOLOGY ABOUT MILLS SPRINGS, MONTICELLO QUADRANGLE, KENTUCKY

BY EDWARD J. FOYLES



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THE GEOLOGY ABOUT MILLS SPRINGS, MONTICELLO QUADRANGLE, KENTUCKY

BY EDWARD J. FOYLES

The Monticello Quadrangle of the U. S. Geol. Survey is bounded by the meridians $84^{\circ} 45' W.$ and $85^{\circ} W.$ and by the parallels $36^{\circ} 45' N.$ and $37^{\circ} N.$ The northeast quarter of this district may be reached by automobile from Burnside, a station on the main railroad between Cincinnati and Cumberland Falls, Ky. Sections were made and fossils collected within the forty-nine square miles of the area. During the three weeks which were spent in studying the stratified rocks enough data were collected to give a comprehensive idea of the physiography, structure, and historical geology of the region.

The field work was done under the direction of Professor E. C. Case of the University of Michigan from the summer camp at Mill Springs. The writer is under deep obligations to Dr. Chester A. Reeds of The American Museum of Natural History, at whose suggestion this study was begun and who gave helpful advice and assistance in the writing of the paper. Negotiations for doing the field work and publication were conducted by Dr. E. O. Hovey. Acknowledgements are also extended to Mr. Charles Butts of the United States Geological Survey for information concerning the stratigraphy of an area nine miles to the southwest of Mill Springs.

PHYSIOGRAPHY

The area possesses the nature of a late mature to old plain on stratified rocks, slightly uplifted and moderately dissected. The Cumberland River flows generally from east to west through several prominently incised meanders (Fig. 1). The relief is striking, the highest hills being more than seven hundred feet above the Cumberland River. These hills present beautiful undulating patches of woods and open glades. At their bases broad areas of upland appear dotted with farms. The river flats or "bottoms" are composed in large part of alluvium which furnishes, when cleared of timber, rich soil for farming. The shifting of the channel in meandering streams to the outside of the bend has left steep

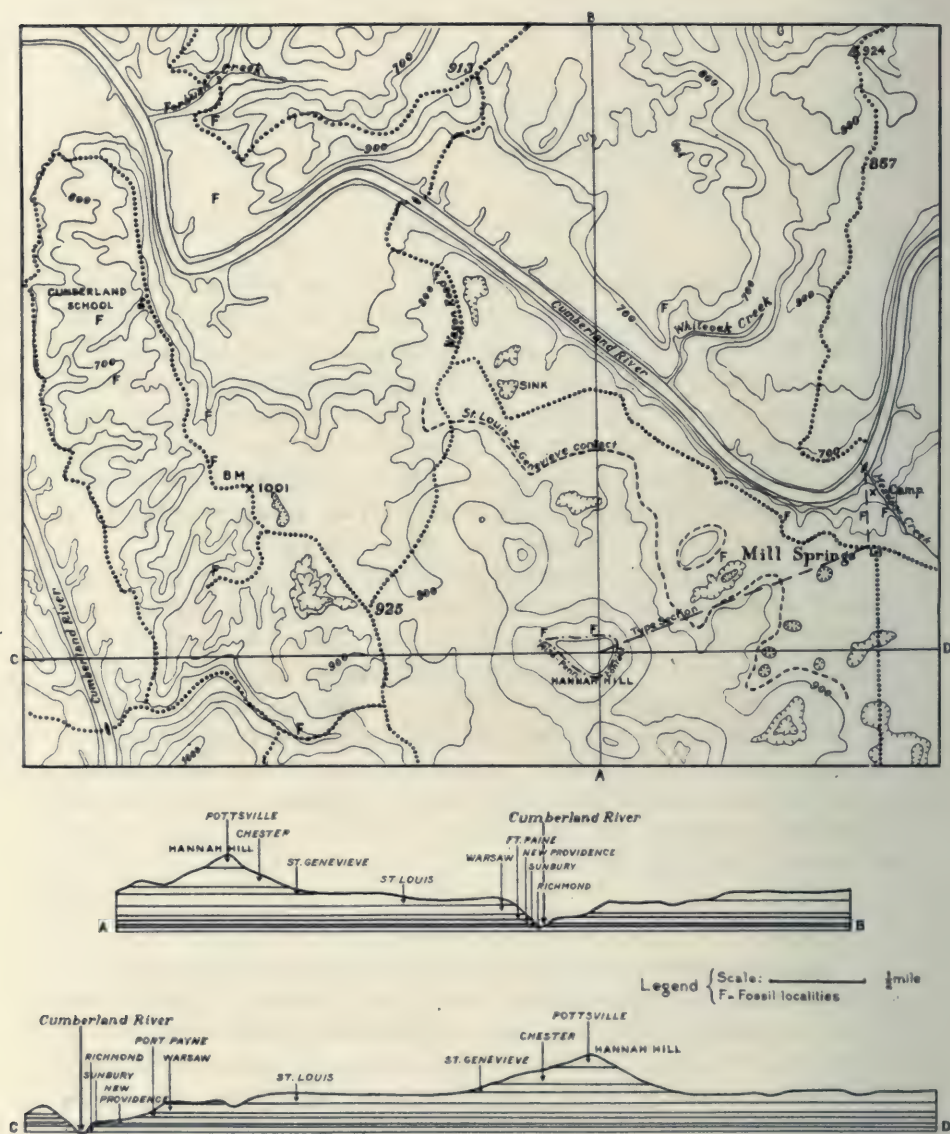


Fig. 1. Sketch Map of the northeast quarter of the Monticello Quadrangle, Wayne County, Kentucky, with profiles along the lines A-B and C-D.

Culture and Topography from U. S. Geol. Surv., Monticello Sheet. Profiles and Geology by E. J. Foyles.

cliffs along the Cumberland and small creeks. This natural phenomenon has interfered with the establishment of good lines of communication along the stream courses and has obliged the settlers to live in more or less isolated communities.

Where the Cumberland River crosses the Monticello Quadrangle it presents the characteristics of a rejuvenated stream flowing on nearly horizontal strata. Three cycles of erosion (Fig. 2) are represented in the area. The top of Hoozer Hill and other outlying knobs are the manifestation of the oldest cycle. The flat upland is representative of the second cycle. The narrow canyons and intervening level stretches along the Cumberland River represent the third cycle.



Fig. 2. Lock at Palace, Cumberland River. In the background may be seen the first, second, and third cycles of erosion.

This area exhibits not only surface but also underground drainage in a limestone plateau where the climate is moist and the strata are nearly horizontal. The sinks form a special feature of the region. Some of these depressions are over 100 feet deep. Short creeks flow into several of them and disappear, indicating that their waters pass through underground channels and issue at the surface elsewhere in the form of springs. Some of these sinks may have been produced by the collapse of the roofs of caves. The field evidence would seem to indicate that the subterranean watercourses were developed, in the main, before the third cycle of erosion or post-Tertiary trenching of the Cumberland valley took place.

STRUCTURAL GEOLOGY

The rocks of the region are nearly horizontal, a fact which may be seen by observing the sections along the lines A-B or C-D on the map (Fig. 1). The only departures from the level character of the strata are caused by low domes and basins. The mouth of Forbush Creek is the center of a dome whose strata rise high enough to expose the Ordovician rocks above the surface of the Cumberland River. Mill Springs is in the center of a broad basin from which the strata rise toward the north, west, and south. The dip of the beds between Forbush Creek and Mill Springs is 15 feet per mile southeast. A greater dip is exposed at the mouth of Cub Creek.

The main section, upon which this report is based, was run from the ferry below the Camp up the steep slope of the hill to Mill Springs and thence to the top of Hannah Hill, a mile and one-half distant to the southwest. This section is shown by a dashed line on the map.

Two disconformities were observed. The first is demonstrated by a mass of decomposed material between the Ordovician and Mississippian beds at the mouth of Forbush Creek. The second, which is between the Warsaw and St. Louis formations, may be seen at Mill Springs where the hard gray limestone of the St. Louis rests on the shale at the top of the Warsaw. An unconformity (Fig. 4) was observed in the Warsaw beds near Mill Springs. The red residual soil at Mill Springs is interpreted as being the natural product of weathering of the St. Louis limestone.

STRATIGRAPHIC GEOLOGY

This area possesses many favorable outcrops for the study of its stratigraphy. Shinbone Cliff on the Cumberland River is one of the finest and largest. Plenty of exposures and some fossils are to be found along the smaller streams. In the deforested uplands rounded boulders appear in the fields and ledges along the roads, while on the slopes of the hills are rocks which have been loosened by frost action. Most of the hills rising above the uplands are densely covered with trees and soil, yet enough outcrops are available for a successful study of the geology.

ORDOVICIAN

RICHMOND BEDS.—At the mouth of Cub Creek the Richmond beds of Ordovician age, some fifty-six feet thick, are represented by thin layers of gray limestone which represent the Arnheim subdivision of this period. The rocks contain sun-cracks, ripple-marks, intraformational mud conglomerate, and miniature cross-bedding, criteria which indicate

that these beds were deposited in shallow water followed by occasional emergence. Aside from dolomite, sphalerite, and calcite crystals in geodes, a few fossils (*Columnaria vacua* Foerste and *Platystrophia cyphoconradi* Foerste) were found at the base of these beds. The 23.5 feet of covered rocks, 12 feet of finely-crystalline gray limestone, and 5 feet of decomposed material underlying the Sunbury black shale near the mouth of Forbush Creek may represent the Saluda horizon, as suggested by Mr. Butts.

MISSISSIPPIAN

At the University of Michigan Geological Camp in the vicinity of Mill Springs, the Mississippian is by far the most extensive and fossiliferous group of rocks, having a total thickness of more than 600 feet. Beginning at the base the formations are the Sunbury shale, the New Providence shale, the Fort Payne shales, cherts and limestones, the Warsaw shales and limestones, the St. Louis limestone, the St. Genèvieve colitic limestone, and the Chester limestones.

SUNBURY SHALE.—One-quarter mile up Forbush Creek occurs an exposure of the black carbonaceous Sunbury shale superimposed disconformably on 5 feet of decomposed Saluda material, the highest Richmond exposed in the area. Although the total known thickness of the Sunbury is 28 feet, only 5 feet appear on Forbush Creek. A careful search for fossils revealed *Ctenacanthus* species, *Pisces* indeterminable, and *Phillipsia* species. It is the teeth of *Ctenacanthus*, a shark, which made it possible to recognize the Sunbury at this place.

NEW PROVIDENCE FORMATION.—Directly overlying the Sunbury on Forbush Creek is the New Providence formation which consists of 29 feet of greenish-gray crumbly shale containing phosphatic concretions the size of marbles and also carbonate of iron concretions. This formation yields the fossils *Cyathaxonia cynodon* Rafinesque and Clifford, *Cliothyridina glenparkensis* Weller, *Platycrinus sculptus* Hall, and *Phillipsia* species. The crinoid *Platycrinus sculptus* Hall is represented in great abundance by its stem-plates which are locally known as "fossil buttons" and "Indian beads."

FORT PAYNE FORMATION.—On the road leading from the Camp to Mill Springs the Fort Payne or Keokuk is exposed vertically for 97 feet at a low-water stage of the Cumberland River. In general, this formation is composed of a stiff dark shale, chert bands, and lenses of coarse, gray and sometimes crinoidal limestone (Fig. 3). The character of these rocks varies greatly in short distances. In the immediate vicinity of the camp

22 feet of gray, nodular, impure shale are exposed at the base, followed by 11 feet of limestone with solution cavities, then 25.5 feet of gray geodic shale. On top of this appear a five and one-half foot lens of gray compact limestone, 21 feet of gray shale with two six-inch chert layers near the top, and 12 feet of gray limestone containing the fossils *Chonetes* species, *Spirifer biplicoides* Weller, *Productus magnus* Meek and Worthen, and *Rhynchopora cooperensis* Shumard.

WARSAW FORMATION.—In the vicinity of Mill Springs the Warsaw, which is well exposed for 92 feet, is divided into six zones. The basal member is composed of 16.5 feet of gray geodic shale containing carbona-



Fig. 3. Outcrop of the Fort Payne Formation, Mississippian, on Meadow Creek, showing limestone lens above hammer and flaggy shale below.

ceous concretions. The next zone consists of 18 feet of brownish-yellow to gray compact limestone. On this lie 16.5 feet of decomposed gray shale which yielded the fossils *Pustula biserialis* Hall and *Chonetes illinoisensis* (Worthen). At the top of this bed, on the road between the camp and Mill Springs, appears a local unconformity (Fig. 4). Overlying this are 22.5 feet of yellow, impure limestone containing *Triplophylum* species. Then follow 13 feet of limestone in which are found the fossils *Spirifer bifurcatus* Hall and *Reticularia pseudolineata* Hall. The last and uppermost member is a gray fissile shale 5.5 feet thick in which no fossils were found.

ST. LOUIS FORMATION.—Lying disconformably on the Warsaw formation is the St. Louis, a hard gray limestone containing the fossils

Lithostrotion basaltiforme Owen, *Lithostrotion proliferum* Hall, *Spirifer bifurcatus* Hall, *Mesoblastus glaber* Meek and Worthen, and *Nautilus* species. Although 34.5 feet of the St. Louis are exposed at Mill Springs, it is probable that the overlying covered rock, 80 feet in thickness, is also a part of the St. Louis. Caverns, sink holes and underground drainage characterize this formation. Due to the soil cover, the contact with the overlying St. Genevieve was not observed. The probable line of differentiation is shown on the map (Fig. 1).

ST. GENEVIEVE FORMATION.—Superimposed on the St. Louis at Hannah Hill 1.5 miles southwest of Mill Springs is the Fredonia forma-



Fig. 4. Local unconformity in the Warsaw beds, Mississippian, on the road between Mill Springs and the University Camp.

tion of the St. Genevieve. Although no contact between the St. Genevieve and the St. Louis was to be seen, it is estimated that the St. Genevieve is 60 feet thick. It is composed of oölitic limestone containing the fossils *Girtyella indianensis* Girty, *Eumetria verneuiliana* Hall and *Lithostrotion harmodites* Edwards and Haime.

CHESTER SERIES.—On the slope of Hannah Hill the Chester is represented by the Gasper and Glen Dean formations totalling a thickness of 146 feet. The Cypress and Golconda formations of this series were not observed. Due to soil cover, the upper and lower contacts of the Gasper, which is a fine-grained crystalline limestone, are difficult to determine. The Glen Dean consists of dark coarsely-crystalline limestone. These formations yielded the fossils *Productus ovatus* Hall,

TABLE OF ROCKS AND FOSSILS OF THE NORTHEAST QUARTER OF THE MONTICELLO QUADRANGLE,
WAYNE COUNTY, KENTUCKY

Group	System	Series	Stage	Sub-stage	Characteristics of Rock	Fossils	Thick- ness in feet
Paleozoic	Pennsylvanian			Pottsville	Yellowish-brown sandstone. Bituminous Pockets		130
		Chester		Glen Dean	Coarse Limestone	<i>Eumetria vera</i> Hall <i>Diaphragmus elegans</i> Norwood and Prattien <i>Productus ovatus</i> Hall	146 ±
				Gasper	Finely-crystalline limestone		
	Mississippian		St. Genevieve	Fredonia	Oolitic Limestone	<i>Lithostrotion harmodites</i> Edwards and Haine <i>Eumetria verneukiana</i> Hall <i>Girtyella indianensis</i> Girty	60 ±
		Mammoth Cave	St. Louis	Salem?	Hard gray limestone. Cherty veins	<i>Lithostrotion basaliiforme</i> Owen <i>Lithostrotion protiferum</i> Hall <i>Spirifer bifurcatus</i> Hall <i>Nautilus</i> species <i>Mesoblastus glaber</i> Meek and Worthen	34.5 +
					Gray fissile shale Grades into limestone		5.5
					Limestone	<i>Reticularia pseudolineata</i> Hall <i>Spirifer bifurcatus</i> Hall	13
			Warsaw		Yellow impure limestone. Local unconformity	<i>Triplophyllum</i> species	22.5
					Incompact gray shale with brown clay	<i>Chonetes illinoensis</i> Worthen <i>Pustula biserialis</i> Hall	16.5
					Brownish-yellow to gray compact limestone		18
					Gray geodic shale Carbonaceous concretions		16.5

Waverly	Ft. Payne	Gray limestone Weathers to a rough white	<i>Choneles</i> species. <i>Productus magnus</i> Meek and Worthen <i>Rhynchopora cooperensis</i> Shumard <i>Spirifer biplicoides</i> Weller	12
		Gray shale merges into limestone. Two six-inch chert layers at top		21
		Gray compact limestone lens		5.5
		Gray geodic shale		25.5
		Limestone. Solution cavities in bed of Meadow Creek		11
	Cuyahoga	Gray nodular impure shale. Cumberland River	<i>Platycrinus</i> species	22
		Greenish-gray crumbly shale Phosphate of lime and carbonate of iron concretions	<i>Cyathazonia cynodon</i> Rafinesque and Clifford <i>Clotthyridina glenparkensis</i> Weller <i>Phillipsia</i> species <i>Platycrinus sculptus</i> Hall	29
		Black Carbonaceous shale	<i>Phillipsia</i> species <i>Ctenocanthus</i> species Pisces indeterminate	5
		Decomposed material		5
		Finely-crystalline gray limestone		12
Ordovician	Richmond	Forbush Creek		23.5
		Thin layers of gray limestone Sun-cracks Ripple-marks Intraformational mud conglomerate Miniature cross-bedding Dolomite, calcite and sphalerite in geodes	<i>Columnaria vacua</i> Foerste <i>Platystrophia cypha-conradi</i> Foerste	56

Diaphragmus elegans Norwood and Pratten and *Eumetria vera* Hall. *Archimedes laxus* Hall and *Prismopora serrulata* Ulrich are diagnostic fossils of the Glen Dean.

PENNSYLVANIAN

POTTSVILLE FORMATION.—Succeeding the Glen Dean is the Pottsville, which consists of a medium-grained yellowish-brown sandstone. On the south side of Hannah Hill there is a bituminous pocket about 8 feet in diameter from which fuel has been dug. This formation, which is 130 feet thick, contains no fossils and caps Hannah Hill.

SUMMARY

The order of superposition, character, thickness, and names of the fossils of each of the beds which have been discussed are summarized in the preceding table.

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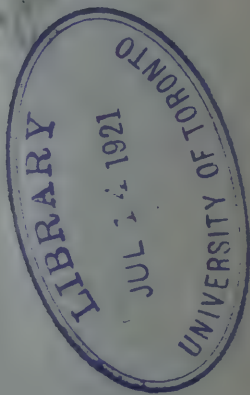
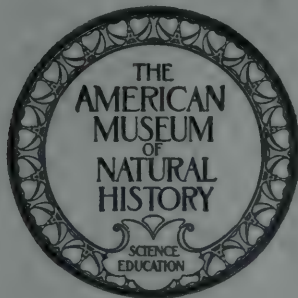
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AMERICAN MUSEUM NOVITATES

No. 12

NOTES ON NORTH AMERICAN BLOOD FLUKES

BY HORACE W. STUNKARD



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NOTES ON NORTH AMERICAN BLOOD FLUKES¹

BY HORACE W. STUNKARD

The first North American blood flukes discovered by the writer were found in 1913, while he was a graduate student at the University of Illinois. In the autumn of that year an extensive parasitological examination of turtles was begun. Shipments of various species of turtles were obtained for this work from collectors in Havana, Illinois; Walker, Iowa; Newton, Texas; and Raleigh, North Carolina. On November 5, 1913, in the washings of the intestine of *Pseudemys elegans* collected near Havana, Illinois, a trematode was discovered which attracted attention by its peculiar and unusual movements. On November 18, 1913, an additional specimen of this particular trematode was found in the oesophagus of another specimen of *P. elegans* caught near Havana, Illinois. On December 15, 1913, a similar trematode was removed from the trachea of *Malacoclemmys leseurii* collected near Newton, Texas. The two specimens removed from *P. elegans* were stained and mounted *in toto*, and that taken from *M. leseurii* was cut in cross-sections. No other specimens were found at that time. The following summer turtles were collected in Iowa and Illinois, and in the autumn a second shipment was received from Raleigh, North Carolina. On examination of this material, the peculiar trematode was again encountered and its true nature discovered. On April 10, 1915, three specimens were removed from the heart and six from the large arteries of *Pseudemys scripta* collected near Raleigh, N. C. During the spring of 1915, blood flukes were removed from the heart and arteries of *Chrysemys marginata* collected in Iowa, Illinois, Indiana, and Ohio; from *Chelydra serpentina* collected in Iowa, Illinois, Ohio, Louisiana, and Texas; and from *Pseudemys elegans* and *Malacoclemmys geographicus* collected in Louisiana. In the fall of 1916, examinations were continued at New York University and blood flukes recovered from the heart and larger arteries of *Chrysemys picta* and *Chelydra serpentina* collected in New York, New Jersey, and North Carolina; and also from *Chelopus guttatus* and *Cistudo carolina* collected at various points in New York and New Jersey. This material obviously belonged to a common genus, but it included forms so different that it was impossible to refer them to the same species.

¹Contribution from the Biological Laboratory, New York University.

The study was interrupted from the spring of 1917 to that of 1919, during which time the writer was in the U. S. army in France. With the resumption of scientific work on release from military service, I found that in a paper dated July, 1918, Dr. G. A. MacCallum had published a description of a trematode from the intestine of *Chelopus insculptus*, so similar to the blood flukes I had collected that it appeared they must be the same. MacCallum named this parasite *Spirorchis*, but omitted the specific name. The blood flukes and the form described by MacCallum are monostomes of almost the same size and shape; they agree in position and character of oral sucker, position and extent of intestinal cæca, position and extent of vitellaria, vitelline ducts and receptacle, position and shape of ovary, oviduct and uterus, position, character and extent of testes, shape and location of seminal vesicle and vas deferens, as well as the position of the excretory pore. They are alike in character of the intestinal contents, which led MacCallum to describe the form as a hæmatophagic trematode. The only points of difference are found in the statement of MacCallum that in *Spirorchis* a pharynx is present and that the genital pore is median near the posterior end of the body, while in the blood flukes a pharynx is absent and the genital pore is lateral, slightly posterior to the level of the ovary.

Conferring with Dr. MacCallum, I learned that the description was made from specimens mounted *in toto*, but unfortunately the slide could not be found. Dr. MacCallum examined several of my slides and noted the similarity between these worms and that described by him, but was not certain that they were the same. In correspondence with Professor Henry B. Ward, of the University of Illinois, under whose direction my graduate work was done and who was familiar with my studies on blood flukes, I wrote on February 2, 1920, that I was certain that the form described by MacCallum as *Spirorchis* is not from the intestine but from the mesenteric vessels and that it belongs to the group of blood flukes, and asked whether in his opinion I should describe the blood flukes as a new genus or assign them to the genus *Spirorchis*. Subsequently, I wrote Dr. C. W. Stiles of the International Commission on Nomenclature, stating the case and asking for information as to the correct method of procedure in determining a name for the blood flukes. In his reply, dated March 1, 1920, Dr. Stiles gave as his opinion that the name *Spirorchis* would be established by "finding the original slide or by collecting material from the type host and type locality and redescribing the genus." "If it proves that your material is identical with *Spirorchis*, I believe that *Spirorchis* would take priority." "According to the rulings

of the International Commission, a generic name may be valid even though no specific name is published with it. The first specific name that is published after the generic name becomes the type of the genus."

In the Journal of Parasitology, March 21, 1921, Ward published certain observations and a description of 'A New Blood Fluke from Turtles,' giving to this parasite the name, *Proparorchis artericola*. He reports that the fluke has been found in several distinct species of turtles and widely separated localities, and records it from *Pseudemys elegans* at Havana, Illinois; *Malacoclemmys leseurii* from Newton, Texas; *Pseudemys scripta* from Raleigh, North Carolina; and *Chrysenys marginata* from Fairport, Iowa. He adds, "The data in my possession are not all referable to the single species which has just been described. In details of structure, in regard to the eggs, in the location in the host in which they have been observed, and in some other details, certain specimens differ so distinctly that I can not at present include them under the same heading." Referring to MacCallum's paper, Ward accepted his diagnosis as it stands, assigned to the form the specific name *innominata*, and included the genera *Spirorchis* and *Proparorchis* as members of a new subfamily Proparorchinæ. He removed the genus *Hapalotrema* Looss 1899, from the subfamily Liolopinæ Odhner 1912, and included it with the subfamily Proparorchinæ in a new family, Proparorchidæ.

Though engaged for several years in the study of blood flukes of turtles, publication has been delayed because of lack of certainty regarding two points; first, the question of nomenclature and the relation of the blood flukes to the genus *Spirorchis*, and second, the difficulty of specific determination of the material at hand. The latter of these questions is still under investigation, and may not be solved until the developmental stages and life history are known; the former has now been answered. The original specimens of *Spirorchis*, to which Ward assigned the specific name *innominata*, have been found, and through the kindness of Dr. MacCallum have been loaned to me for examination. After careful study I wish to make certain corrections and additions to the description of the form. As noted previously, the only cardinal differences between the blood flukes and the description of MacCallum are the presence or absence of a pharynx, the position of the genital pore, and the location within the host. The structure described as a pharynx in *Spirorchis*, though it somewhat resembles such an organ, is in reality the œsophageal commissure of the nervous system and no pharynx is present. The œsophagus is surrounded by unicellular glands which at the posterior region are large and stain deeply. The genital pore is ventral, below the

cæcum of the left side, a short distance posterior to the level of the ovary. MacCallum traced the cirrus sac to the intestine, but was unable to follow the genital ducts to the structure he regarded as the genital pore. It is a significant fact that though MacCallum reported the parasite from the intestine, he noted that its intestinal content showed it to be a hæmatophagic trematode. As Ward pointed out, "It is not unlikely that its presence in the intestine was accidental, due to the opening of some blood vessel during the dissection." The first blood flukes found by the writer were discovered in the washings of the intestine after its dissection, and though I have not as yet been able to secure specimens of *Spirorchis* from the circulatory system of *Chelopus insculptus*, I have found eggs of blood flukes in the tissue of that species and I am still of the opinion stated over a year ago that the specimens described by MacCallum came originally from mesenteric blood vessels.

On the basis of morphological similarity, there can be no doubt that the blood flukes of turtles belong to the genus *Spirorchis*. I have specimens collected from the same hosts and the same localities as those of Ward, and which are certainly specifically identical with his material. These specimens show no generic differences from those discovered by MacCallum. The generic description of *Proparorchis* as given by Ward agrees with the corrected description of *Spirorchis*, demonstrating the identity of these forms. With the establishment of their identity, *Proparorchis* disappears as synonym. With the synonymy of *Spirorchis* and *Proparorchis* and the suppression of the latter name, the subfamily and family names Proparorchinæ and Proparorchidæ also disappear. *Spirorchis* remains then as the only known genus and type of the subfamily to which it belongs, and for which, in conformity with the rules of zoological nomenclature, I propose the name **Spirorchinæ**. I agree with Ward that *Haplotrema* does not find a natural position in the subfamily Liolopinæ of the family Harmostomidæ, and that it must be removed from those groups. It differs from *Spirorchis* in the location of the ovarian complex and genital pore and also in the possession of an acetabulum. No existing subfamily will contain it, and it may well be considered as the type of a new subfamily, the **Haplotremineæ**. Ward included *Haplotrema* and the Proparorchinæ (syn. Spirorchinæ) in a new family, for which I propose the name **Spirorchidæ**.

In position of female organs and genital pore, *Spirorchis* resembles *Aporocotyle* and manifests relationship to that form. The discovery of the American blood flukes of turtles establishes a firmer basis for the conception of the unity and evolution of the blood inhabiting trematodes.

In my opinion, the Aporocotylidæ of fishes, the Spiorchidæ of turtles, and the Schistosomidæ of birds and mammals constitute a well-defined group with inherent natural relationships. The Spiorchidæ stand in an intermediate position, and the schistosomes are, I believe, derived through them from the Aporocotylidæ rather than from the Harmostomidæ as maintained by Odhner.

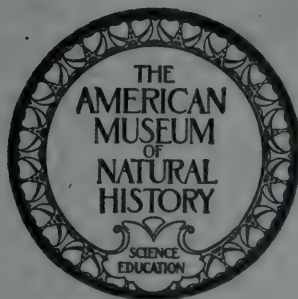
Specimens of *Spiorchis* collected from various species of turtles, on which these notes are based, form part of the collection of blood flukes in the Department of Lower Invertebrates of The American Museum of Natural History.

AMERICAN MUSEUM NOVITATES

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NEW GENERA OF PALEOCENE MAMMALS

By W. D. MATTHEW AND WALTER GRANGER



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NEW GENERA OF PALEOCENE MAMMALS

BY W. D. MATTHEW AND WALTER GRANGER

In the course of the revision of the Puerco and Torrejon faunas of New Mexico and the description of the more recently discovered Tiffany fauna of southwestern Colorado, several new genera were recognized, which it seems advisable to place on record in advance of the full description.

MULTITUBERCULATA

Plagiaulacidæ

*Ectypodus*¹ *musculus*, new genus and species

TYPE.—No. 17373, upper jaw from the Mason pocket, Tiffany beds, Animas Co., Colorado.

TOPOTYPES.—A series of seven upper and lower jaws and many isolated teeth and jaw fragments, all from the Mason pocket.

GENERIC CHARACTERS.—Dentition: $\frac{1.1.4.2}{1.0.1.2}$. Teeth much as in *Ptilodus*, except that p^4 is of simple trenchant type instead of molariform. The crown is triangular in cross-section and there are seven tubercles on the interior cutting edge. On the outer face of the crown near its anterior border there are usually two (one in type) minute tubercles; these appear to be a rudiment of the second row of tubercles which in *Ptilodus* extends the full length of the tooth. P^1 and P^2 are tricuspid; p^3 is quadricuspid. The lower jaw (topotypes) is similar to *Ptilodus*, except that P_3 is absent.

SPECIFIC CHARACTERS.— $P^1-M^3=6.2$ mm.

Eucosmodon,² new genus

TYPE.—*Neoplagiaulax americanus* Cope, of the Puerco formation, Lower Paleocene of San Juan basin, New Mexico.

GENERIC CHARACTERS.—Agrees with the true *Neoplagiaulax*, of the Cernaysian of France, in absence of P^3 (present in *Ptilodus*), but differs from both of these genera and from *Ectypodus* in the large, compressed, fully scalpriform incisor, rootless or nearly so. The species are of considerably larger size than those of the three above-named genera.

¹ἐκτυπος=carved in relief; δδoίς=tooth; in reference to the peculiar type of sculpture of the lower premolar.

²εὖ=well; κοσμος=ornament; δδoίς=tooth.

MARSUPIALIA

Didelphidæ

*Peradectes*¹ *elegans*, new genus and species

TYPE.—No. 17376, a pair of lower jaws, nearly perfect, from the Mason pocket, Tiffany beds, Colorado.

PARATYPE.—No. 17369, upper jaw with M¹⁻⁴.

GENERIC CHARACTERS.—Dentition: $\frac{1.1.3.4}{1.1.3.4}$. Upper molars tritubercular, paracone and metacone subequal, styler cusps weak, conules rudimentary. Last upper molar transverse. Lower molars with high trigonids and deep basin heels, paraconid well developed, anterointernal; premolars simple, with high compressed protoconids and small heels on P₂₋₃. Molars increasing somewhat in size from first to third, the fourth slightly smaller with narrower heel. Canines moderately large, as in *Marmosa*. Jaw slender, with inflected angle as in opossums.

SPECIFIC CHARACTERS.—Size minute, P₁–M₄ = 11 mm.

About fifteen specimens of upper and lower jaws of this genus were obtained from the Mason pocket, it being, next to *Nothodectes*, the most abundant form. The generic characters separating *Peradectes* from *Peratherium* are found principally in the upper teeth.

*Thylacodon*² *pusillus*, new genus and species

TYPE.—No. 16414, a fragment of lower jaw, with m₂₋₃, the heel of m₁ and part of alveolus of m₄, from the upper level of the Puerco formation near Ojo Alamo, San Juan basin, New Mexico. Exped. 1913.

GENERIC CHARACTERS.—Molar teeth of didelphid type, rather narrow as a whole, the trigonid relatively high, with reduced paraconid. Metaconid and protoconid high, well separated, acute, the protoconid considerably the higher. Talonid deeply basined with acute marginal cusps, the entoconid internal, hypoconulid well developed on all molars and nearly posterointernal in position (a characteristic didelphid construction), hypoconid postero-external. The high bicuspid trigonid and reduced paraconid serve to distinguish this from other didelphid genera; the tooth is also unusually narrow and the hypoconulid and entoconid more distinct than usual.

SPECIFIC CHARACTERS.—M₂₋₃ = 5. mm.; M₁₋₃ = 7.2 mm. (approx.). Size of the larger species of *Marmosa*, about a third larger than *M. chapmani*.

Represented in the collection by the type specimen only.

INSECTIVORA

Leptictidæ

Leptacodon *tener*,³ new genus and species

TYPE.—No. 17179, lower jaws with badly crushed front of skull, from the Mason pocket, Tiffany beds, Colorado.

¹τῆρα = pouch; δῆκτης = biter; i. e., a carnivorous marsupial. Also suggestive of its relative *Peratherium*.

²θύλακος = pouch; ὀδούς = tooth, i. e., marsupial tooth.

³From λεπτός = small, delicate; ἀκὴ = point; ὀδούς = tooth. Intended to be also suggestive of its relationship to *Leptictis* and *Diacodon*.

FAMILY CHARACTERS (Leptictidæ).—Jaw long, slender with low condyle, prominent narrow angular process curving downward and backward, not inflected, coronoid process low, broad. Upper molars tritubercular, paracone and metacone subequal, external, with strong cingulum around outer base but stylar cusps rudimentary, conules minute, protocone large, suberescentic, hypocone small but prominently projecting; lower molars with short high trigonids and large basin heels; p^4 molariform except that *me* is smaller than *pa* and *pr* and *hy* smaller than in true molars. p_4 molariform, but with pa^d strong, projecting prominently forward, anterior premolars moderately large, compressed, simple, not crowded.

GENERIC CHARACTERS.—Trigonids lower than in *Diacodon*, paraconids distinct, molars reduced in size from first to third. Protoconid overtopping inner cusp. The least specialized in molars and premolars of any member of the Leptictinæ.

SPECIFIC CHARACTERS.—Size minute, $P_2-M_3=7.3$ mm.

Xenacodon¹ mutilatus, new genus and species

TYPE.—No. 17407, a right ramus of the lower jaw with P_4 , M_2-3 and alveoli of remaining teeth, from the Mason pocket, Tiffany beds, Colorado.

GENERIC CHARACTERS.—Dentition $\overline{3.1.4.3}$. Incisors small, canine of moderate size, P_1 two-rooted, P_4 with large, well-separated metaconid and protoconid, rudimentary paraconid and very small heel. Molars as in *Diacodon* and *Palæolestes* with high trigonids of two principal cusps well separated, very small paraconids, large high-cusped heel with deep basin opening inward, high external hypoconid and posterior hypoconulid, entoconid smaller, posterointernal and imperfectly separated from hypoconulid. Distinguished from other genera of Leptictidæ principally by the peculiar character of its P_4 .

SPECIFIC CHARACTERS.—Size of *Palæolestes puercensis* ($M_2-3=7$ m.) which it resembles in general proportions. Third premolars considerably more robust; the first and second of subequal size, both being two-rooted. Premolars not spaced and only a very small space behind the canine, which is a somewhat larger tooth than in *P. puercensis*.

Represented in the collection by the type only.

Acmeodon² secans, new genus and species

TYPE.—No. 16599, a part of the lower jaw with P_2-M_2 and the root of the canine preserved. From the upper level of the Torrejon formation, Torrejon Arroyo, San Juan basin New Mexico. Exped. 1913.

GENERIC CHARACTERS.—Dentition $\overline{1.1.3.3}$. Molars of leptictid type but trigonid not so high and paraconid better developed than in *Diacodon* or *Palæolestes*. P_4 of peculiar pattern, the principal cusp (protoconid) much compressed and crested, with strong accessory cusps (paraconid, protostylid) on the anterior and posterior edges and a somewhat weaker posterointernal cusp (metaconid) connected by a prominent crest with the apex of the protoconid; also a well-developed basined talonid with acute posteroc-external and posterointernal cusps (hypoconid, entoconid).

¹ξένος= strange; ἀκμή= point; ὀδόν= tooth. In reference to the very peculiar p_4 , which appears at first glance to be a broken and incomplete tooth.

²ἀκμή= a crest or edge; ὀδόν= tooth.

P₃ large, simple, high, acute and compressed, with anterior postero-external and posterointernal crests, and a small, low, simple, acute heel-cusp. P₂ much smaller, simple, with anterior and posterior crests and a minute heel-cusp. Canine rather small, oval in cross-section at base. At least one small incisor is present.

SPECIFIC CHARACTERS.—P₂-M₂=19.3 mm.; M₁₋₃=10.6 mm. (approx.). A faint rudiment of anterior basal cusp on P₂ and P₃; on P₄ it is distinct; protostylid a faint rudiment on P₃; on P₄ this is a strong cusp connected by a crest with the apex of the protoconid.

In addition to this type there is a second specimen, paratype No. 16600, a jaw fragment with P₄-M₁ and alveoli of remaining molars, from the same horizon as the type, Escavada wash.

MENOTYPHILA

Plesiadapidae

*Labidolemur*¹ *soricoides*, new genus and species

TYPE.—No. 17400, lower jaws with incisors, M₁ right and left, and alveoli of remaining teeth; from Mason pocket of the Tiffany beds, Colorado.

GENERIC CHARACTERS.—Dentition, $\overline{1.0.1.3}$. Jaw short and of moderate depth; incisor greatly enlarged, semiprocumbent, considerably curved upward towards the tip, crown trihedral, with sharp, knife-like, coarsely serrate outer margin, anterior face flattened convex, root elongate. Fourth premolar much reduced, probably two-rooted, crown unknown, diastema much reduced owing to enlargement of incisor. First molar with a moderately high trigonid of two subequal cusps (protoconid and metaconid) well separated, and a low ledge-like paraconid appressed to anterior margin; large rounded basin heel. Third molar with elongated heel. Coronoid process low, narrow, projecting strongly backward, angle flat and of moderate width, with narrow backward projection at tip. Mental foramen below anterior edge of M₂.

SPECIFIC CHARACTERS.—M₁₋₃=5.7 mm. (approx.); length of incisor crown (lingual side)=6.7 mm.

This form is close to *Phenacolemur* of the Wasatch beds of Wyoming, but is distinguished from it by the apparently greatly reduced premolar. In *Phenacolemur* this is a large robust tooth, exceeding in size the first molar. It is possible that *Labidolemur* is the lower dentition of *Ignacius* (*infra*) but there are evidently two forms of small plesiadapids in the Tiffany beds as indicated by lower incisor teeth, one as in the present genus and the other with a much simpler, laterally-compressed and straighter crown.

Aside from the type this new form is represented in the collection from the Tiffany beds by a lower incisor, No. 17402, and, somewhat doubtfully, by two other specimens, Nos. 17401, 17405, in each of which

¹ *adls* = pincers and *Lemur*.

the last lower molar is preserved. This tooth shows the peculiarly broad elongated talonid and is structurally similar to that in *Phenacolemur*, but compared with this latter genus both *Labidolemur* and *Ignacius* are minute.

? Plesiadapidae

*Ignacius*¹ *frugivorus*, new genus and species

TYPE.—No. 17368, upper jaw with C, P⁴-M² and alveoli of remaining cheek teeth. From the Mason pocket of the Tiffany beds, Colorado.

GENERIC CHARACTERS.—Dentition, $\frac{1.1.2.3}{2.1.2.3}$. Canine small, simple, double-rooted, pointed. P³ two-rooted, p⁴ nearly as large as m¹, submolariform, metacone much smaller than paracone, and no crest connecting metacone with protocone, otherwise this tooth is similar to the true molars. Molars with subequal outer cusps, no external styles, minute protoconules, a broad sloping shelf occupying the postero-internal angle of the tooth. Low crests connect the protocone with the two outer cusps.

SPECIFIC CHARACTERS.—C-M²=8.3 mm.; M¹⁻³=6. mm. (approx).

Two specimens, Nos. 17377, lower jaw with one molar, and 17408, loose lower incisor, premolar and molar, may pertain to this genus. The incisor is a slender, gently tapering lanceolate tooth; the premolar, presumably P₃, is two-rooted, with subconical protoconid and well-developed heel. The molars have a trigonid of two opposite, nearly equal cusps, connected nearly to their tips, and no paraconid; the talonid is broad, basined, and without hypoconulid. A transverse crest connects the hypoconid with the metaconid.

PRIMATES

Tarsiidae

Navajovius kohlhaase,² new genus and species

TYPE.—No. 17390, upper and lower jaws, probably of the same individual, from the Mason pocket in the Tiffany beds, Colorado.

GENERIC CHARACTERS.—Dentition, $\frac{1.1.1.3}{2.1.2.3}$. Two lower incisors somewhat enlarged, with elongate roots and long, pointed, subspatulate crowns. Canine smaller, one-rooted, premolariform. Third premolar smaller than canine, two-rooted, crown comparatively simple; P₄ nearly as large as M₁, with trenchant heel and rudimentary metaconid. Lower molars tritubercular, with distinct but small paraconid extended outwardly as a low ledge; protoconid and metaconid equal, submarginal, talonid basined, wide and deep. Upper fourth premolar not as large as M¹, with large sub-

¹From the town of Ignacio, Colo., about seven miles west of the Mason pocket.

²From the Navajo mountains north of the San Juan River. As a mnemonic convenience the names of our new Tarsioid genera have all been derived from various mountain ranges in the region where they were found, the names chosen being of Indian derivation, and most of them originally applied to Indian tribes of the region; and they are latinized in the same form as *Tarsius*.

The species name is in honor of Miss Erna Kohlhaase, to whose skilful and patient work is due the preparation of the minute and delicate specimens from the Tiffany beds herein described.

trigonal external cusp and rudimentary internal cusp. Molars tritubercular with rudimentary hypocones on M^1 and M^2 , conules minute, no external stylar cusps.

SPECIFIC CHARACTERS.— $C-M_3=7.5$ mm.; $M_{1-3}=4.7$ mm.

Represented in the collection by the type only.

This is the only true primate thus far described from the Paleocene. The Plesiadapidae are primitive types lying on the border between Primates and menotyphlan insectivores.

INCERTÆ SEDIS

Carpodaptes¹ aulacodon, new genus and species

TYPE:—No. 17367, lower jaw with P_2-M_3 , alveolus of P_1 and part of canine alveolus. From the Mason pocket of the Tiffany beds, Colorado.

GENERIC CHARACTERS.—Dentition, $\overline{1.1.4.3}$. Canine moderately large; anterior premolars much reduced, single-rooted, knob-like, fourth premolar enlarged, secant with scalloped edge and obscure grooving toward apex of the crown. No diastemata. Molars fundamentally of tarsiod type but considerably specialized in various respects; M_2 the smallest of the series; trigonid of M_1 converted into an antero-posterior crest; protoconids of M_2 and especially of M_3 lower and smaller than metaconids; molar heels large and deeply basined. Jaw short, rather deep anteriorly, mental foramen below P_2-3 .

SPECIFIC CHARACTERS:— $P_2-M_3=8.5$ mm.; $M_{1-3}=5$ mm.

Represented in the collection by the type only.

This form cannot be definitely assigned to any family or order; it may be a primate, a menotyphlan insectivore, or neither.

CREODONTA

Triisodontidae

Eoconodon, new genus

TYPE:—*Sarcothraustes coryphæus* Cope, 1888, = *Triisodon heilprinianus* Cope, 1882. From the Paleocene (Puerco formation) of the San Juan basin, New Mexico.

A more careful restudy of the type of the genus *Triisodon*, *T. quivirensis* Cope, in connection with additional and better preserved material of the Triisodontidae, shows that it is not congeneric with *T. heilprinianus* and other species of the Puerco fauna, but that it is congeneric with *Sarcothraustes* (type *S. antiquus*) of the Torrejon fauna, which it antedates as a generic name. Moreover, the records of its locality and associated material, with the field data obtained by Mr. Granger in 1913 as to the exposure of the Puerco and Torrejon formation, confirm the suspicion that it is a Torrejon and not a Puerco species. The

¹καρπός = fruit; δάκνη = eater, bloodsucker; in reference to the supposed habits indicated by the character of the teeth, especially the enlarged cutting premolar. The species name refers to the vertical grooving of the tooth, which shows some analogy to the Plagiaulacidae and the modern rat kangaroos.

Puerco genus represented by *T. heilprinianus* (syn. *T. biculminatus*, 'Sarcothraustes' *coryphæus*, etc.), requires a new generic name. The type of *T. heilprinianus* is very incomplete and its exact provenience unrecorded, so that it appears better to base the genus upon *S. coryphæus* founded upon an excellent type known to have come from the true Puerco, but considered at present as a synonym of *T. heilprinianus*.

This genus is nearly related and appears to be directly ancestral to *Triisodon* of the Torrejon, the type of which genus is *T. quivirensis* Cope, 1881. The distinguishing characters separating *Eoconodon* from *Microclænodon* and *Triisodon*, the other two genera of the Triisodonti-dæ, are as follows: trigonids low, metaconids and protoconids slightly connate, subequal, paraconid strong, heel large, basined.

Oxycænidæ

*Mixoclænus*¹ *encinensis*, new genus and species

TYPE.—No. 16601, upper and lower jaws with P^3-M^3 , P_2-M_1 left, and roots of M^{2-3} right, preserved. From the lower level of the Torrejon formation, east fork of Torrejon arroyo, San Juan basin, New Mexico. Exped. 1913.

GENERIC CHARACTERS.—The upper molars resemble those of *Chriacus*, but are wider transversely, and more triangular, external angles more prominent, hypocone less so, M^3 much reduced, transverse. Premolars with blunt-pointed, somewhat inflated crowns, more as in *Miocænidæ*, and the more primitive *Anisonchinae*. Lower canine small, partly premolariform. Jaw elongate, shallow, condyle not transverse.

SPECIFIC CHARACTERS.— $C-M_3=26$ mm.; $M_{1-3}=10$ mm.

In addition to the type there is a paratype, No. 17074, a lower jaw with nearly complete dentition, and two other lower jaw fragments. All four specimens are from the lower level of the Torrejon formation.

The lower dentition of this genus is very much like that of *Coriphagus* Douglass of the Fort Union. Until the upper dentition of *Coriphagus* is discovered it appears better to hold *Mixoclænus* provisionally distinct.

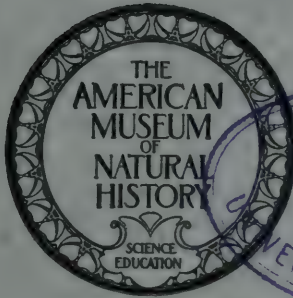
¹*μῖτος* = mingled; (*Mio*) *clænus*, (*Oxy*) *Clænus*, etc.; in reference to the synthetic character of the dentition.

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No. 14

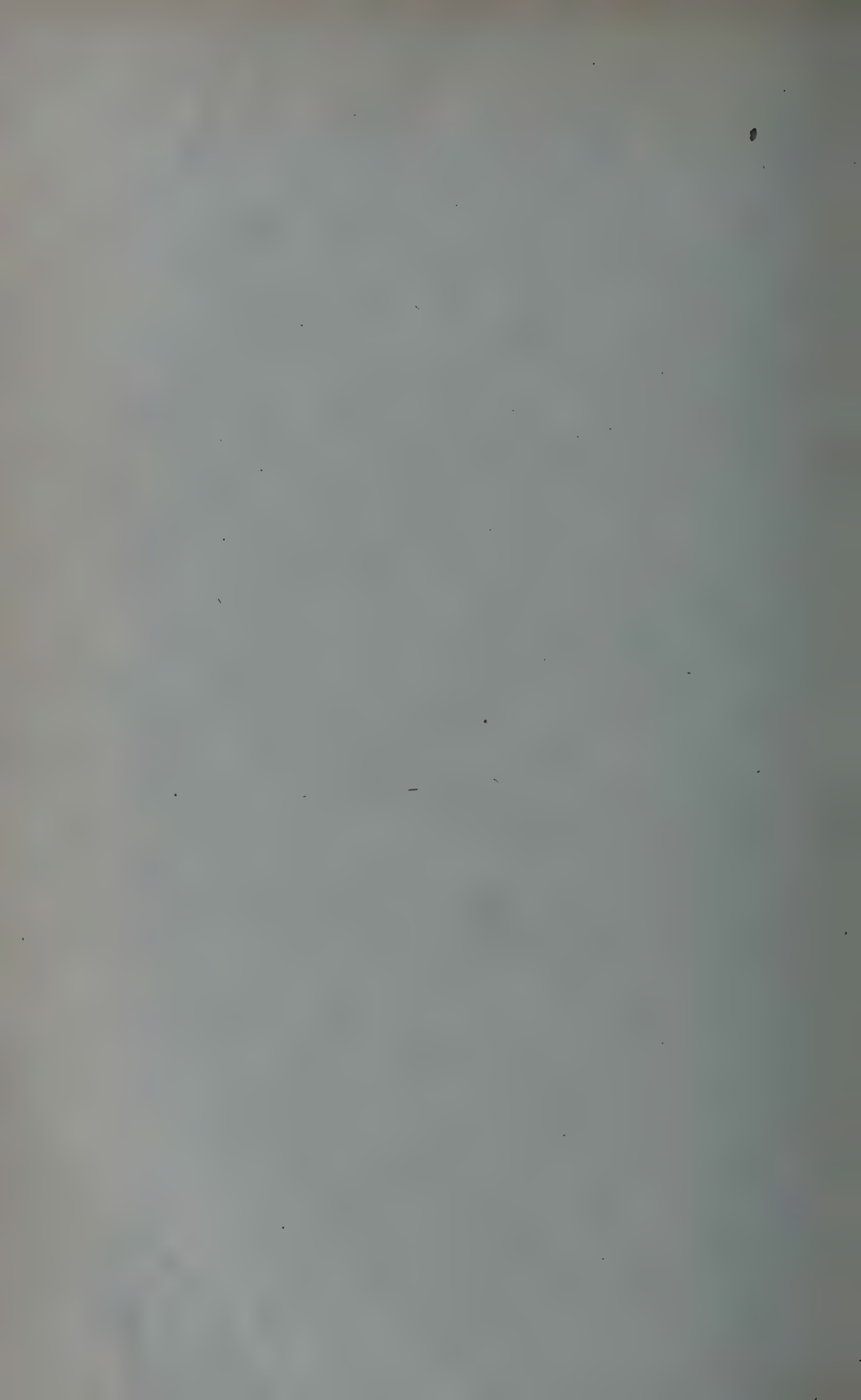
STEHLINIUS, A NEW EOCENE INSECTIVORE

By W. D. MATTHEW



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STEHLINIUS, A NEW EOCENE INSECTIVORE

By W. D. MATTHEW

In 1895 Mr. O. A. Peterson, of The American Museum of Natural History, obtained from the Uinta basin of Utah a block of shale showing numerous fragments of small vertebrates, among which the most interesting was an incomplete and badly crushed skull and jaws of a small mammal which Dr. Wortman immediately recognized as a "new insectivore," but which has never been described. I prepared this specimen under the binoculars several years ago but withheld description, hoping to have opportunity to dissect out and reconstruct the displaced fragments of the skull. I have concluded, however, that it involved too much risk to be advisable. Miss Erna Kohlhaase worked over the large block from which it had been removed, hoping to find skeleton parts or other fragments, but, although she found a number of small rodent jaws and skeleton bones of small mammals and reptiles, there was nothing that could be confidently referred to the little insectivore. Its singular and highly specialized dentition made its affinities wholly obscure, and it was only in recent years that the researches of Stehlin upon the Plesiadapidae and the discovery of several genera of this family in the Eocene and Paleocene of this country cast some light upon its probable affinities. It now appears to be an extremely specialized plesiadapid, possibly related to *Necrosorex* Filhol. The reduction of the cheek teeth is carried further even than in *Apatemys* but, unlike that genus, a large and very remarkable cutting premolar is retained in the lower jaw. This tooth, long and knife-like, has no anterior root, the base of the crown resting upon the large front tooth; the posterior root is normal. This singular construction is explicable as due to the re-enlargement of a tooth like that of *Apatemys*, which is small, knife-like and single-rooted; or else to the progressive degeneration of the anterior root due to its being crowded out through the progressive enlargement of the front tooth.¹

¹Neither explanation appears entirely satisfactory: the former is in accord with what is actually known of the phyletic record both in this family and in the parallel case of the Plagiaulacidae; but will be sternly rejected by certain advocates of "irreversibility in evolution" who attach a very different meaning to Dollo's Law from that explained by its distinguished proponent. The mechanics of the second interpretation appear to be unsound: a slight deepening of the jaw or backward migration of the anterior root would obviate any interference from the root of the front tooth, and the anterior root of a large knife-like tooth of this description would function so importantly in keeping it firm and true that it would be wholly unlikely to degenerate and disappear if there were any way of avoiding such a loss. Once lost, of course, and the tooth dependent for its support solely upon the posterior root and such bracing as it might obtain from its proximity to the socket and root of the large tooth in front, one can understand that a re-enlargement might fail to develop a new anterior root through fission of the posterior root, but instead permit it simply to rest against this anterior brace. In any event, the mechanics of this construction is very remarkable.

***Stehlinius uintensis*, new genus and species**

TYPE.—No. 1903. A right lower jaw, with part of the skull from the Upper Eocene (Uinta) of White River, Utah. Exped. 1895.

GENERIC CHARACTERS.—Dentition $\frac{1.0.2.3}{1.0.1.3}$. Incisors soricoid, greatly enlarged and root and crown much elongated, trihedral in cross-section, the crown of the upper incisor unknown, the lower incisor curving upward towards tip, the wearing surface on the posterior face obliquely concave, the enamel confined to the anterior face of the tooth. Third upper premolar indicated by a single rather large, oval alveolus, the form of the crown unknown. Fourth upper premolar small, trenchant, pointed.

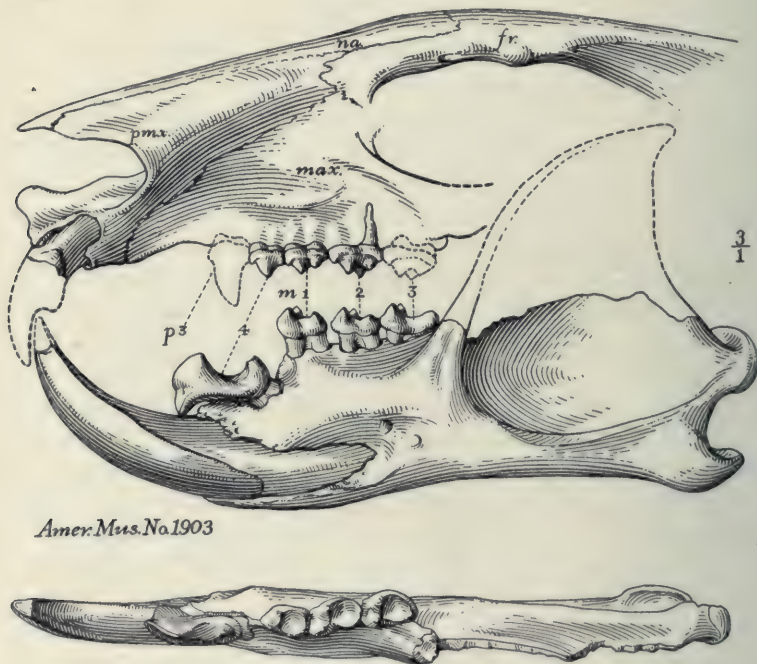


Fig. 1. *Stehlinius uintensis*, skull and lower jaw, side view, type specimen, Upper Eocene, Utah.

Skull reconstructed from the crushed original, lower jaw reversed. Three times natural size.

Upper molars brachyodont, trihedral, scalene to a marked degree, paracone and metacone prominent, rounded, subequal, parastyle and metastyle well developed, but no mesostyle; protocone prominent, rounded, posterior wing absent, anterior wing extended into a crest meeting the paracone. Lower premolar enlarged, the crown compressed and elongated, with the anterior part raised into a knife-edge and the posterior part with a strong heel-cusp. The posterior root is normal, the anterior root absent, the anterior part of the crown resting upon the incisor. Lower molars with oblique crested trigonids and large basin talonids, the paraconids being low and not

prominent. Lower jaw of moderate depth, with broad coronoid process, condyle but slightly expanded transversely, angle broad, not inflected, ending posteriorly in a stout hook-like process.

Reconstruction of the Skull

The anterior part of the skull is preserved, but so broken and distorted that its reconstruction as shown in the accompanying figure is partly conjectural, and therefore not included in the generic diagnosis.

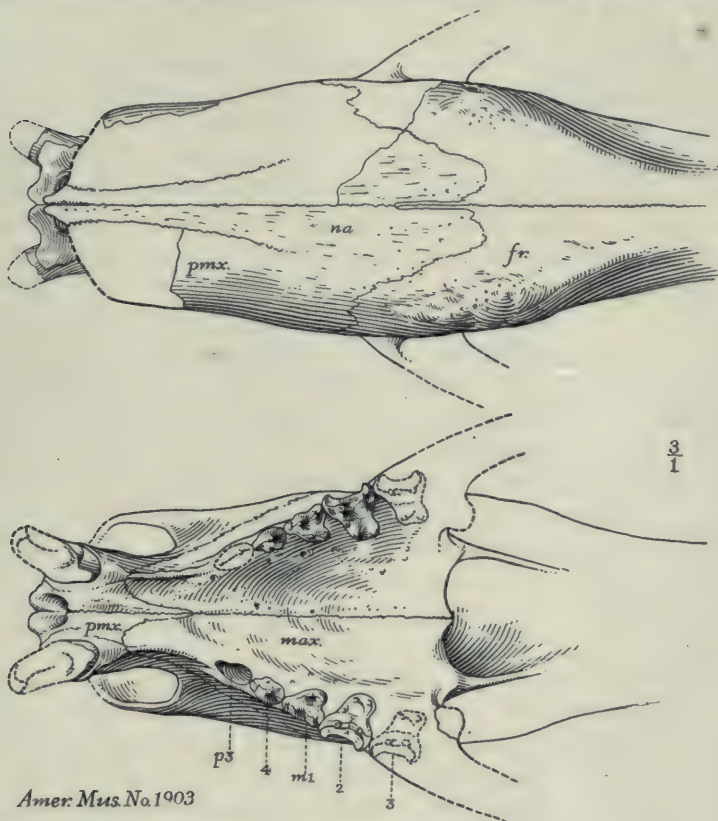


Fig. 2. *Stehlinius uintensis*, type specimen.

A, reconstructed skull, top view; B, palate partly reconstructed. Three times natural size.

The reconstruction was drawn by Mr. Erwin Christman and is the final resultant of a series of critical studies and attempts at reconstructing the type skull by Mr. Christman, Dr. Gregory and the author; but it remains a tentative and not a positive resultant. The width and character

of the nasals and premaxillæ is based upon somewhat doubtful identification of the displaced fragments. The sutures, which are mostly well shown and afford the best evidence for the identity of these fragments, are indicated wherever we regard them as positively identifiable.

The most remarkable features of the skull are the great expansion of the ascending ala of the premaxilla, and the long and wide posterior overlap of the nasal on the frontal bone. This is clearly seen to be a superficial overlap, the frontal extending beneath the nasal plate as far forward as the preorbital line, and showing at the surface in a narrow thread along the median suture. In the marsupials the nasals are greatly extended and expanded posteriorly, but there is little or no overlap on the frontals except laterally in some forms (*Didelphys*, etc.).

The postorbital process of the frontals is indicated only by a slight rugosity, as in most Insectivora. The postorbital crests behind it are obscure, and the constriction not marked. The skull is broken off at about the line between parietals and frontals, but this suture is not certainly recognizable.

Owing to the broad ascending premaxillary plates, the width of the muzzle is considerable, but the body of the premaxilla is narrow, the incisors set close together, and above and partly in front of the incisor is a process and crest which may have been extended upward in a bony septum between the anterior nares, but is broken off in the specimen.

The palate is narrow at the incisors, but widens rapidly backward, with the maxillo-premaxillary suture crossing it in the middle of a moderately long diastema between the incisor and p^3 . There is some doubtful indication of another small tooth in this diastema. The posterior border of the palate is somewhat doubtfully recognized just back of m^3 .

Affinities

The characters of the teeth place this genus as a specialized member of the Plesiadapidæ. It may be nearly related to *Necrosorex* Filhol, of the French Phosphorites, although clearly not identical (*Necrosorex* has one too many alveoli, even if one ignores the differences in its m_3 as due to careless drawing); and, if so, it confirms Dr. Stehlin's transfer of the Phosphorite genus from the Soricidæ, where Filhol very naturally placed it, to the neighborhood of the Plesiadapidæ; thus affording another instance of the insight of this distinguished palæontologist in recognizing the true affinities of so fragmentary and deceptive a type. It has seemed appropriate on this account that the Uinta genus should be named in Dr. Stehlin's honor.

The skull characters are not very close to those of *Nothodectes*, the only genus of this family in which anything of the skull has been described. Although the skull is badly crushed in *Nothodectes* and difficult to interpret, I cannot find in it any evidence for the backward extension and expansion of the nasals or the relatively enormous ascending plate of the premaxilla that characterize *Stehlinius* if we have correctly reconstructed this part of the skull. These are marsupial, and especially diprotodont marsupial, characters; but, as noted above, the nasal expansion in this genus is a superficial overlap, quite unlike the marsupial conditions, and probably a secondary specialization from the normal primitive insectivore type; the expanded premaxillary plate is presumably also secondary and indicates parallel adaptation, not relationship to the diprotodont marsupials. Marsupial relationship is, in fact, wholly excluded by the dentition, characters of the jaw, etc.

The new genus is referred to the Plesiadapidæ chiefly upon the evidence of the teeth, and without prejudice to possible claims to relationship with *Mixodectes* or *Microsyops*, which at present are assigned to distinct families.

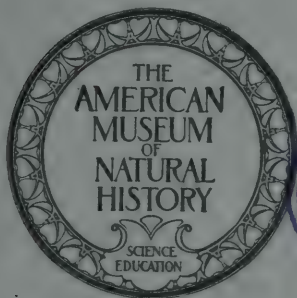
The ordinal position of this whole assemblage of genera is very doubtful. Stehlin regards the Plesiadapidæ as chiromyoid primates; Gregory and Matthew consider them as tupaoid insectivores (*Menotyphla*); but in any event they stand near the boundary line between the two orders. The present genus has no especial suggestion of primate about it; but that is of little significance.

AMERICAN MUSEUM NOVITATES

No. 15

A NEW NAME FOR A SUBSPECIES OF *UTA* *STANSBURIANA* BAIRD AND GIRARD

BY KARL PATTERSON SCHMIDT

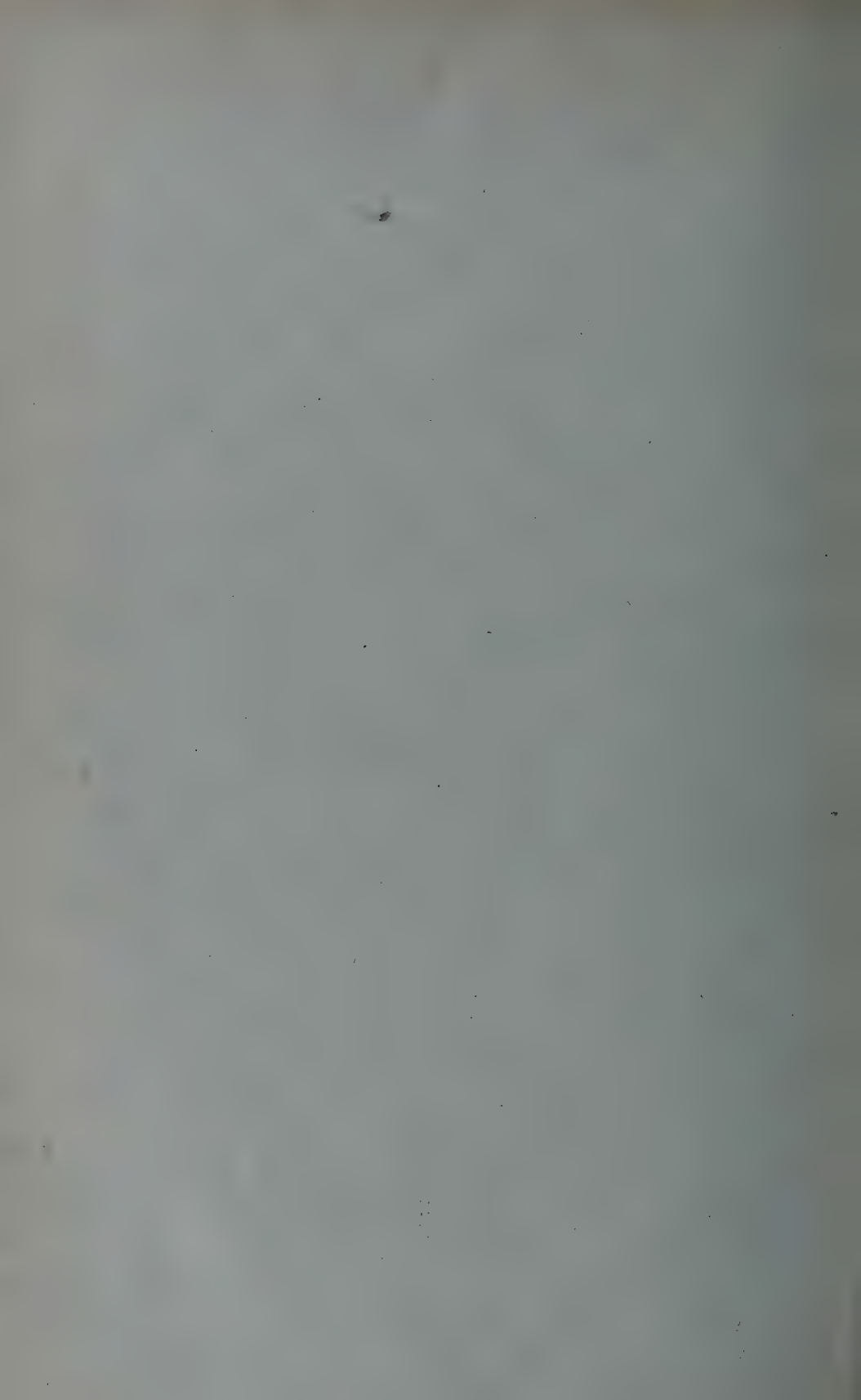


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A NEW NAME FOR A SUBSPECIES OF *UTA STANSBURIANA* BAIRD AND GIRARD

BY KARL PATTERSON SCHMIDT

In the 'Check List of North American Amphibians and Reptiles' (1917), Stejneger and Barbour have followed Richardson (1915, Proc. U. S. Nat. Mus., XLVIII, p. 412, ff.) in his revision of *Uta stansburiana*.

Richardson divides the species into a northern subspecies, *Uta stansburiana stansburiana* (Baird and Girard), chiefly in the Great Basin; a southern subspecies, *U. s. elegans* (Yarrow), ranging from western Texas to Lower California; and a Pacific coast form, *U. s. hesperis* Richardson, of the coastal region of southern California and northern Lower California (and the San Joaquin Valley).

To the second subspecies Richardson applied the name *elegans* of Yarrow (1882, Proc. U. S. Nat. Mus., V, p. 442), with the type locality La Paz, Lower California. Richardson, however, had only four specimens of *Uta elegans* from the Cape Region of Lower California.

The Lower Californian collections of the Albatross Expedition made in 1911, contain an excellent series of *Uta elegans* from Lower California, numbering twenty-four specimens (seven from the vicinity of La Paz); in addition, through the courtesy of the U. S. National Museum, I have had an additional six specimens from the Island of Espiritu Santu, opposite La Paz, for examination.

The *Uta stansburianas* from Texas, New Mexico, and Arizona in The American Museum of Natural History agree excellently with Richardson's definition of *U. s. elegans*. The Lower Californian specimens, however, are at once distinguished in the greater length of the hind leg, which ranges from .74 to .85 of the length from snout to anus in eighteen male specimens, averaging .80, while in twenty-four male Arizonan and New Mexican specimens examined by me, the range is .65 to .79, average .71, and the average of Richardson's series of twenty-three males is .74.

I, therefore, regard the form in the Cape Region of Lower California as specifically distinct, and restrict the name *elegans* of Yarrow

to it. For the form in Arizona, New Mexico, western Texas, and northern Mexico, I propose a new name.

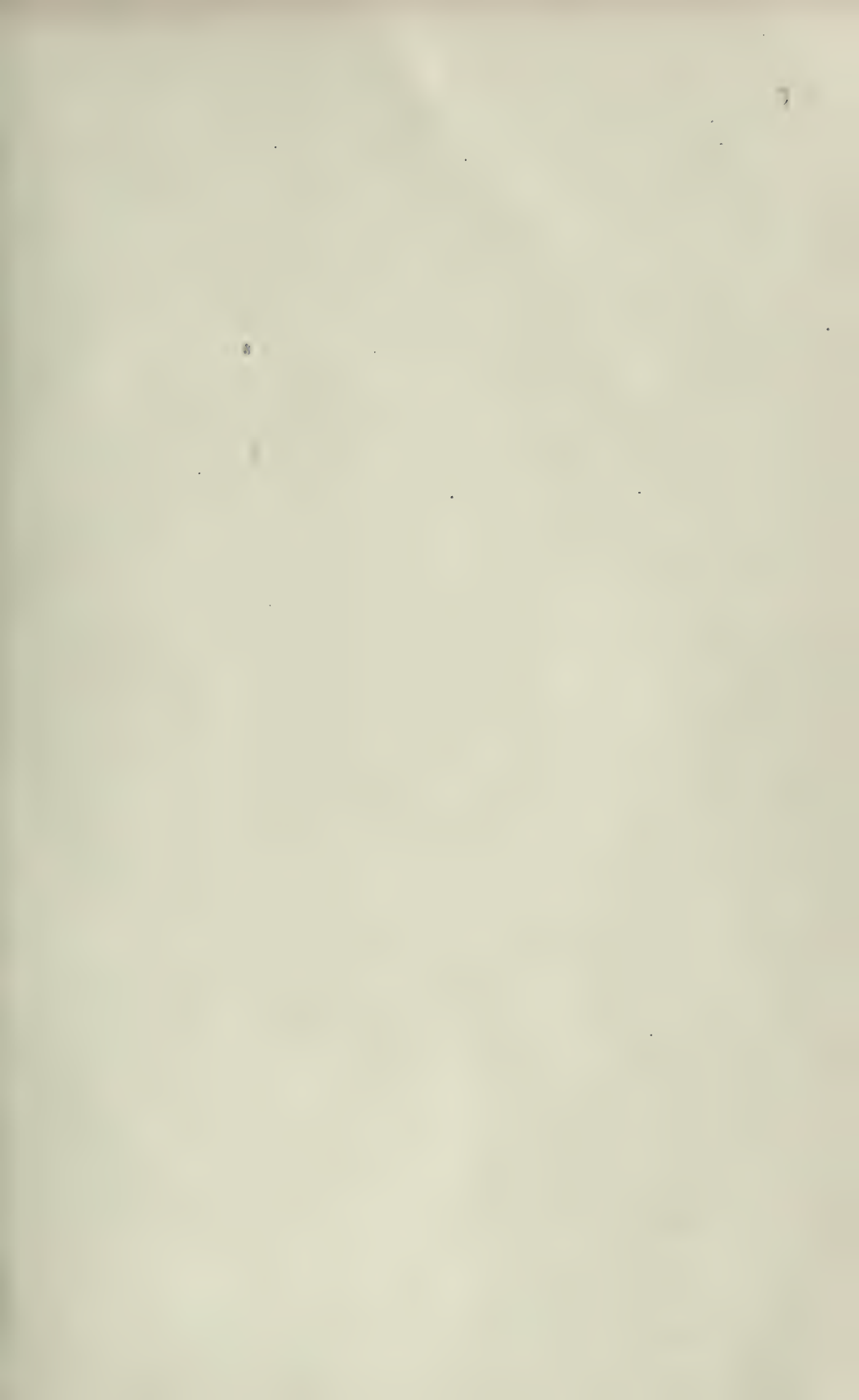
***Uta stansburiana stejnegeri*,¹ new name**

TYPE.—A. M. N. H. No. 348; ♂; collected July 23, 1906 by A. G. Ruthven.

TYPE LOCALITY.—Mouth of Dry Cañon, Alamogordo, Otero County, New Mexico.

It is hoped that a more extended study of the genus *Uta* may be presented in the future.

¹Named for Dr. Leonhard Stejneger, whose contributions to the study of the genus *Uta* make it especially appropriate that a species of this genus should bear his name.

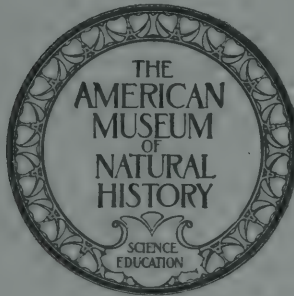


AMERICAN MUSEUM NOVITATES

No. 16

A REVISION OF *ATLAPETES GUTTURALIS*
WITH DESCRIPTIONS OF THREE NEW RACES.

BY JONATHAN DWIGHT AND LUDLOW GRISCOM



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A REVISION OF *ATLAPETES GUTTURALIS* WITH DESCRIPTIONS OF THREE NEW RACES

BY JONATHAN DWIGHT AND LUDLOW GRISCOM

The recent receipt of excellent material from Guatemala, Nicaragua, and Costa Rica of this wide-ranging highland species led to the discovery that the series from the localities mentioned above differed markedly from each other. Accordingly other available material was brought together, resulting in a series of nearly 100 specimens, representing thoroughly age, season, and locality. A careful study of this series shows that Dr. Chapman's *brunnescens* is restricted to the highlands of Chiriqui, and that the birds inhabiting the geographically isolated highlands farther north constitute three well-defined races to be described below.

Several other points have come up in the course of our study which we here record. The first is that skins in the course of time (in less than thirty years, certainly) unquestionably turn brown, and are therefore useless for subspecific comparison, a fact which Dr. Chapman has already recorded for many species from old Bogotá collections. We have seen such discolored skins from "Bogotá," Costa Rica, and Guatemala, and it was the receipt of fresh material from Costa Rica which first called our attention to this fact. When Dr. Chapman described *brunnescens* and referred all Central American material to this race, he had only a few birds from Nicaragua, three old skins from Costa Rica, and an old Lawrence skin from Guatemala in addition to an excellent series from Chiriqui. These old skins have turned brown and are not separable from Chiriqui specimens, but fresh material proves to be quite different. Mr. Ridgway, the only other ornithologist who has treated the species at all recently, lists only six specimens.

While we describe the Nicaraguan bird below, additional material having been acquired, it is only proper to state that it could never have been described with the material which Dr. Chapman had available. It differs but slightly from *brunnescens*; in fact, we would hesitate to describe it were it not for the fact that a different race in Costa Rica separates it from its closest relative. This leads to a second fact about *Atlapetes gutturalis*, namely, that its racial variation is not geographically progressive from one end of its range to the other. Thus, the Costa Rican

race is very close to typical *gutturalis* from Colombia, and would scarcely be worthy of a name were it not for the very distinct *brunnescens* intervening. Similarly, as stated above, the Nicaragua form is closely related to *brunnescens*, while the Guatemala race, far from continuing what might be called the subspecific tendency of the Nicaraguan bird, is distinct from either of the other two groups. This type of variation is already known for several other highland species in Central America, and results unavoidably in a considerable number of subspecies, some of which are very close indeed.

The variations due to age and season are well shown by the series at hand, which also illustrates the moults, so that comparisons of like plumages may be made and subspecific differences better determined. Every month in the year is represented and in the series are a number of moulting birds which follow the usual course of the moult in sparrows and finches. The postnuptial or annual moult takes place in the fall during August, September, October, and November, the Colombian birds being about a month later than the others. Two Chiriqui birds of August 21 and September 21 each still retain the old first (ninth) primary while the other wing-quills, the tails, and a large part of the body plumage are new. In two Colombia birds of October 26 and November 13 all the primaries are new, the first (ninth) about one half grown. Although this moult is in the fall in all of the races, the young seem to leave the nests at different periods. Birds in full juvenal plumage of the Costa Rica and Chiriqui races are dated May, June, and July, acquiring their first winter dress through a partial moult by the end of August, while similar birds of the Colombia race dated March have acquired their winter dress by the end of March. It is probable that the time of the rainy season in the different regions governs the time of moult and occasions the variations.

These birds do not suffer much from wear. The tendency is for the feathers of the back to become paler. When fresh, they often have dusky margins, and loss of these as well as fading tend to make the grayer feathers paler and the browner feathers lighter, although each preserves its original tone to a large degree.

There is also a partial prenuptial moult in the spring involving only some of the head, throat, and anterior parts of the body. This freshens up the plumage and is most noticeable perhaps on the back. An understanding of the plumage changes is needful in order to comprehend the variations that are entirely geographical.

We give below diagnoses of the five subspecies of *Atlapetes gutturalis*. All measurements are in millimeters. The special color names employed

are taken from Ridgway's 'Color Standards and Color Nomenclature' (1912). We are indebted to Mr. Waldron deWitt Miller for his courtesy in letting us study and describe the Nicaraguan material.

***Atlapetes gutturalis gutturalis* (Lafresnaye)**

SUBSPECIFIC CHARACTERS.—Back deep mouse-gray; white headstripe broad, throat patch lemon-yellow; breast whitish; flanks and under tail-coverts deep olive-gray; averaging very slightly larger than any other race, bill decidedly larger.

MEASUREMENTS.—Males: wing, 73–80 (77.4); exposed culmen, 15–17 (15.5). Females: wing, 71–79 (74.1); exposed culmen, 14–16 (15.1).

RANGE.—Highlands of Colombia, 3000–8500 feet.

SPECIMENS EXAMINED.—♂ 10; ♀ 14; not sexed 5; juv. 5.

***Atlapetes gutturalis brunnescens* Chapman**

SUBSPECIFIC CHARACTERS.—Decidedly browner than typical *gutturalis*. Back between olive-brown and fuscous; headstripe narrower; throat patch slightly deeper yellow; breast whitish; flanks and under tail-coverts buffy brown; size similar to *parvirostris*, smaller than *gutturalis*, particularly the bill.

RANGE.—Highlands of Chiriqui.

SPECIMENS EXAMINED.—♂ 14; ♀ 1; not sexed 3; juv. 10.

***Atlapetes gutturalis parvirostris*, new subspecies**

SUBSPECIFIC CHARACTERS.—Very similar to typical *gutturalis*. Back very slightly darker gray; headstripe equally wide; throat patch slightly lighter yellow; breast whitish; flanks light grayish-olive; averaging slightly smaller with a noticeably smaller bill, in this respect resembling *brunnescens*.

TYPE.—No. 52724, Coll. J. Dwight; ♂ ad.; Aquinares, Costa Rica, altitude 4500 feet, March 27, 1920.

MEASUREMENTS.—Males: wing, 70–78 (73.6); exposed culmen, 13–15 (14). Females: wing, 72–76 (74.0); exposed culmen, 14.

RANGE: Highlands of Costa Rica.

SPECIMENS EXAMINED.—♂ 7; ♀ 2; juv. 5.

***Atlapetes gutturalis fuscipygius*, new subspecies**

SUBSPECIFIC CHARACTERS.—The brownest of all the races. Most closely resembling *brunnescens*, but upper parts even browner, especially on the lower back and rump, approaching raw umber; headstripe narrow as in *brunnescens*; throat patch and breast similar; flanks and under tail-coverts saccardo-umber, much browner than in *brunnescens*; size of the other Central American races.

TYPE.—No. 101517 A. M. N. H.; ♂ ad.; San Rafael del Norte, Nicaragua, altitude 4000 feet, April 14, 1907.

RANGE.—Highlands of north central Nicaragua.

SPECIMENS EXAMINED.—♂ 3; ♀ 3.

***Atlapetes gutturalis griseipectus*, new subspecies**

SUBSPECIFIC CHARACTERS.—Not closely resembling any of the other races. Back lighter in tone than *parvirostris* and more olive, olive-gray rather than mouse-

gray; headstripe broad, as in typical *gutturalis* and *parvirostris*; throat patch lighter yellow and more extensive than in any other race; breast distinctly clear gray, not whitish as in other races; flanks and under tail-coverts saccardo-olive, more olive, and less brown or gray than other races; size of the other Central American races.

TYPE.—No. 52725, Coll. J. Dwight; ♂ ad.; Quezaltenango, Guatemala, altitude 8500 feet, November 18, 1919.

RANGE.—Highlands of central Guatemala.

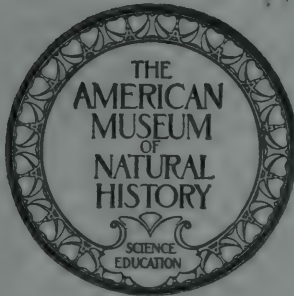
SPECIMENS EXAMINED:—♂ 5; ♀ 2; not sexed 1.

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No. 17

NOTES ON A NEW OX-PECKER AND OTHER LITTLE-KNOWN BIRDS OF THE CONGO

By JAMES P. CHAPIN



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BY JAMES P. CHAPIN

In the working up of our collection of Congo birds there appear continually points of interest regarding the distribution and relationships of the rarer birds of this region, which seem to merit immediate publication and a little more space than can be allotted to them in the final report. For this reason, we offer the following remarks on species recently subjected to special investigation.

A NEW *BUPHAGUS* FROM THE LOWER CONGO

The Tick-birds or Ox-peckers of Africa have been universally conceded to belong to two species, both of them widely distributed over the eastern and southern parts of Africa and both extending to Senegal in the northwest. Yet, they invariably shun the forested regions, especially of the Congo basin; and, while Professor Reichenow² states that *Buphagus africanus* is found locally in the western forest area, he gives in his great work only one such record from Lower Guinea: Gaboon (Marche and Compiègne). In his list of birds known from the Cameroon³ we find no mention of either species.

This is entirely in accord with our experience during the American Museum Congo Expedition. Nowhere in the forested districts did we ever see or hear of an Ox-pecker, not even where cattle or horses were being kept, as at Stanleyville. But there are parts of the Gaboon which are certainly not to be reckoned as forest, since numbers of savanna birds extend their range northward from the Lower Congo along the west coast, and one of these must be a *Buphagus*.

At Faradje, Upper Uele District, where in 1911 some 700 head of cattle were living on the Government farm and the European traders and administrative agents possessed a few horses and mules, no Ox-peckers ever came to visit the domestic animals, although this was well to the north of the forest border. With the big game of the region, however, and even farther south near the Kibali River, there were frequently

¹Scientific Results of the American Museum Congo Expedition. Ornithology No. 6.

²1903, 'Vögel Afrikas,' II, p. 666.

³1911, Mitteilungen aus dem Zool. Mus. Berlin, V, p. 251.

Tick-birds of the so-called yellow-billed species, whose bill nevertheless has the terminal half bright red. They were found in rather small numbers in attendance upon the white rhinoceros, buffalo, giant eland, and occasionally even the wart-hog. Their well-known habits need no mention here; but the facts that they never approached human habitations and were never observed about the cattle are rather surprising.

Along the eastern border of the Belgian Congo, and especially in the Katanga, Ox-peckers of both the yellow- and red-billed species must doubtless occur; yet the only other place where any *Buphagus* was observed by us was at Zambézi, on the Lower Congo. There Mr. Van Saceghem, a Belgian veterinary, kindly procured two specimens for me in January 1915; and Mr. Lang collected three more in June and July of the same year. They were seen commonly about the domestic cattle, and yet only a few miles away at Boma I sought in vain for them with the herds. I was even told that they did not show themselves on the Island of Mateba, where cattle raising is the principal industry. According to Mr. Drouot, Directeur de l'Agriculture at Boma, they were not seen at Zambézi previous to 1908, appearing first in company with a herd installed at some little distance north of the river; and then, when these were brought back to the station, the birds came too.

Both Mr. Lang and I noticed at once that these Ox-peckers were of a much darker color, especially on the rump, than those of the Uele; and later I found that they agreed more or less in coloration with *Buphagus erythrorhynchus*, even to the dark shade of the rectrices. Yet the bill, instead of being entirely red, had been bicolored exactly as in *B. africanus*. Comparison with specimens made it clear at once that *erythrorhynchus* had a bill of quite another shape, yet this difference between the two well-known species, while alluded to in Stark and Selater's 'Birds of South Africa,' is generally disregarded in favor of color distinctions that are not at all evident in the beaks of old dried skins.

The bill of *Buphagus africanus* is much heavier than that of *B. erythrorhynchus*, especially on account of the pronounced widening of the basal half of the mandible, the sheath of which, in many adult specimens, is even produced inwardly below so as to encroach upon the feathering of the chin. This character was enough to place our darker birds from Zambézi unquestionably in the *africanus* group, and, furthermore, they lacked all trace of the widened yellow eyelid of *erythrorhynchus*.

Were the species of this curious group of birds more numerous, it would doubtless be fitting to divide them in two genera, and such well-

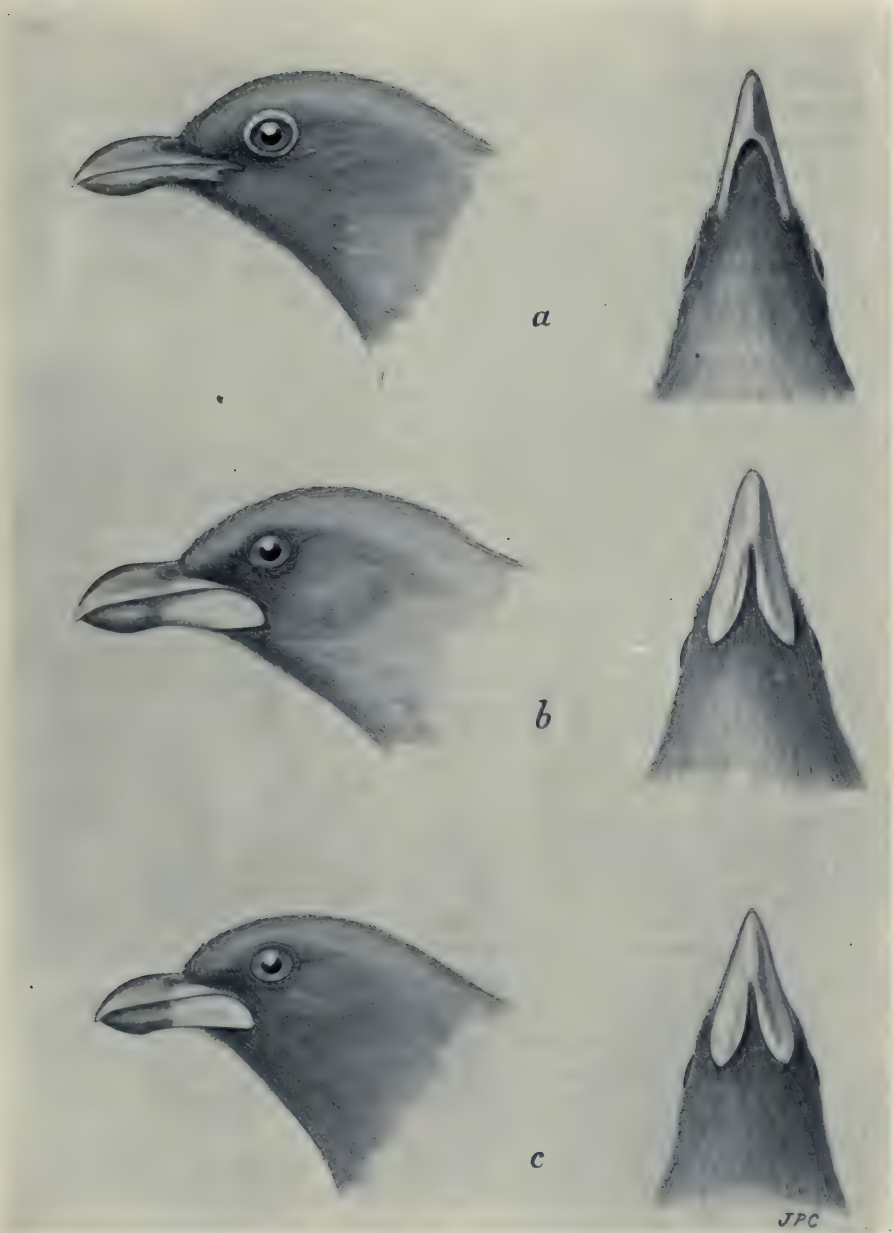


Fig. 1. Beaks of the three species of Ox-peckers, as seen from the side and beneath.
 A, *Buphagus erythrorhynchus*; b, *B. africanus*; c, *B. langi*. Natural size.

marked characters would be amply sufficient for the purpose. As matters stand, I propose the subgeneric term **Buphagoides** to distinguish the species *erythrorhynchus*.

An examination of the specimens of *Buphagus africanus* in the American Museum, the Academy of Natural Sciences of Philadelphia, and the Museum of Comparative Zoology (eleven specimens from widely different parts of the continent) fully confirms the color differences between the common Yellow-billed Ox-pecker and that of the Lower Congo. Not only does the latter represent a hitherto undescribed form, but, since there is no evidence whatsoever of intergradation between them, I consider it as specifically distinct from *Buphagus africanus* and restricted in all probability to the Lower Congo and the adjoining part of the Gaboon. It may well be that the record of Marche and Compiègne refers to this dark form. I propose to name it in honor of Mr. Herbert Lang, leader of the American Museum Congo Expedition, with whom I have worked during five pleasant years in Africa.

Buphagus langi, new species

SPECIFIC CHARACTERS.—Related to *B. africanus*, but smaller and more darkly colored, especially on the breast and on the rump, the latter being grayish instead of rich yellowish buff. No rufous on the rectrices.

TYPE.—♀ ad.; A. M. N. H. No. 163005; Zambi, Lower Congo, January 16, 1915.

DESCRIPTION OF ADULT FEMALE (Type).—Whole head and throat dull dark brown ("fuscous" of Ridgway); back, wing-coverts and secondaries similar; the primaries and their greater coverts fuscous black; under wing-coverts fuscous. Lower rump and upper tail-coverts "grayish olive"; rectrices darker, like the back, both on inner and outer webs. Below, the dark brown of the foreneck shades gradually to a dull cinnamon-buff on the lower breast, abdomen, and under tail-coverts, while the flanks are of a warmer ochraceous buff, tinged with cinnamon. Iris yellow; base of bill bright yellow, its distal half scarlet; feet blackish.

MEASUREMENTS OF TYPE.—Wing, 107; tail, 74; culmen, 15; tarsus, 21.

Of the four remaining specimens, one is an immature male, one an immature female, and the two others have bills like adults, but were not sexed. One of these from its rather large size is presumed to be an adult male, yet it is slightly darker than the type.

The immature male has the whole bill still dark brown, and exhibits an ashy wash over the head, back, and chest, which I believe to be characteristic of the first plumage.

Measurements of Five Specimens of *Buphagus langi* (both sexes).—Wing, 106.5–113 (average, 109.1); tail, 74–81 (77.9); culmen, 13.5–15 (14.2); tarsus, 20.5–21.5 (21). The dimensions of *B. africanus*

are given by Reichenow ('Vögel Afrikas,' II, p. 666) as: wing, 120; tail, 90-105; bill, 16-18; tarsus, 21-23. The wing does vary, I find, from 117 to 124 mm., but *Buphagus africanus* does seem to be a decidedly larger bird.

THE NECTARINIA OF THE BANGALA COUNTRY

This long-tailed genus of Sunbirds is especially characteristic of the plains regions of Africa and, until a few years ago, seemed to be without a single representative in forested western Africa. Then, in April 1910, van Oort¹ described both male and female of a new species, *Nectarinia congensis*, which had been sent in alcohol from Boma on the Lower Congo by A. Greshoff to the Zoological Laboratory in Utrecht, and there had remained unnoticed for twenty-one years.

No further reference to the species has appeared since its original description, as a result, I believe, of the true range of this fine Sunbird along a river where few ornithologists have tarried to make collections. Some nine months before van Oort's description appeared, we were making the ascent by steamer of the Upper Congo River, profiting by every stop to jump ashore and secure specimens, mostly of birds. The Sunbirds in particular attracted our attention, but no long-tailed species was noticed at Boma, Matadi, or Leopoldville, nor indeed until we had reached Bumba, on July 29. At Barumbu, two days later, we collected an adult male specimen, and thereafter saw no more of the species, even during our stay at Stanleyville.

It may seem strange that a Sunbird characteristic of the forested course of the Congo River should not occur on the Upper Aruwimi or the Ituri, yet such appears to be the case. Stranger still is the fact that *Nectarinia congensis* was not found by us at even Stanleyville during October and November, 1914.

I determined therefore to keep a special watch for it on the way down the Congo and, at the end of the very first day's journey, at Isangi, the acquaintance was renewed. About the government station there some of the roads are lined with the beautiful tree *Poinciana regia*, known as the "Flamboyant" and introduced, I am told, from Madagascar. To its gaudy red flowers, now open in great numbers, there came a few of the Sunbirds I sought, and a male and female were secured.

The next day we stopped for an hour at Barumbu, and here on the same kind of flowering tree I again watched a few of these Sunbirds. On other native trees they were observed later near Lié, near Coquil-

¹1910, Orn. Monatsb., p. 54.

hatville, and at Irebu (December 17), usually near or over the river-bank. All our specimens, with the exception of one not quite fully adult, were found to be in breeding condition; this was even the case with the male taken in July.

Near Lié a typical Sunbird nest was hanging from a bush, some six feet above the water, and a male of *Nectarinia congensis* sitting by it seemed to prove the ownership, though, because of the flooded condition of the stream, it could not be reached during our very short stop.

Below Irebu this species of Sunbird disappeared and, though I collected subsequently for several weeks in the neighborhood of Boma, it was never seen there either. I cannot help feeling that Greshoff's specimens really came from much farther up the river. Two days below Irebu by steamer the Congo emerges from the equatorial forest into the southern savanna, with a very distinct fauna; and what forest one sees along the Congo near its mouth is mainly a very heavy growth of mangrove. If our Sunbird inhabited this, we may take it for granted that it would long ago have been collected on the Gaboon coast. So far as my observations go, *Nectarinia congensis* inhabits the banks of the Upper Congo, from Irebu, near the entrance to Lake Tumba, up to Isangi, at the mouth of the Lomami River. The distance is about 500 miles, but I suspect that the birds keep very much to the banks of the larger streams in this region and never go beyond the limits of the equatorial forest belt.

Van Oort's description is very good, especially in view of the long sojourn of his specimens in alcohol. All we need add to it is that the burnished green chest of the male has a bluer posterior edge, sometimes even violet, and that the longer upper tail-coverts are of a like shade. In the case of the female, the upper side of the tail shows a faint green gloss, and the foreneck is heavily spotted with dull blackish.

With regard to measurements, those of the eight males in our collection are: wing, 63-66 (average, 64.5); middle rectrices, 110-125.5 (117.3), second longest pair, 49-52.5 (50.7); exposed culmen, 19-20 (19.3); metatarsus, 16-16.5 (16.1). The two females have smaller dimensions: wing, 56, 59; middle rectrices, 44.5, 45; second pair, 41, 41.5; exposed culmen, 16, 18.5; metatarsus, 15.5.

NEOLESTES CABANIS AND ITS ALLIES

At the confluence of the Kasai and Congo Rivers, on December 19, 1914, I made the acquaintance of a bird subsequently identified as *Neolestes torquatus* Cabanis, collecting three specimens. Having no

means of learning its name at the time, I attempted at least to determine the family which it represented and, from the general form of body, limbs, and other details, I soon decided that it belonged with certainty to the Pycnonotidæ, in spite of the rather unusual color pattern, largely green above, white and gray below, with crown and nape ashy, and a broad black line extending from the lores to behind the eye and down across the breast. The bill reminded me of that of *Pycnonotus*, but was wider and more arched; the feet did not belie such a relationship, the metatarsi being short and scutellate. The sexes were alike in color. I felt the more confident because all three of my specimens, shot among the bushes in upland savannah, had been eating small fruits; and their voice was a sort of twitter that suggested a Bulbul.

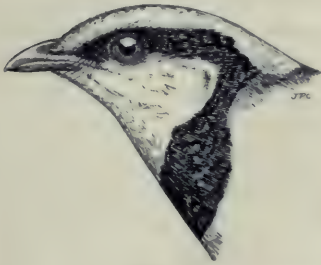


Fig. 2

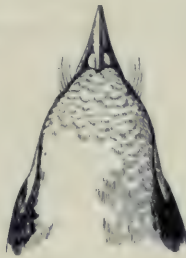


Fig. 3



Fig. 4

Fig. 2. Head of *Neolestes torquatus*, adult male.
Natural size.

Fig. 3. Head of *Neolestes torquatus*, from above.
Natural size.

Fig. 4. Left foot of *Neolestes torquatus*.
Natural size.

Later in the same day, at Kunzulu, somewhat farther down the Congo River, a nest of this same bird was found in a bush, four feet from the ground. It was a frail cup of slender grasses and plant stems, holding two eggs, pinkish white indistinctly speckled with darker pinkish and a faint rufous zone about the larger end. Here, I thought, were additional indications of affinity to the Pycnonotidæ.

During the following month, January, near Boma on the Lower Congo, three more individuals were observed, though none was collected, because of their extreme wariness.

When I came to the identification of my specimens at the American Museum, no genus of Pycnonotidæ could be found in which they seemed to fit, and my search extended to the Laniidæ before it bore fruit. There

the monotypic genus *Neolestes* was placed by Reichenow¹ in the following association: "*Chlorophoneus*, *Pelicius*, *Neolestes*, *Calicalicus*, *Nicator*. . . ." Dr. Sharpe,² too, includes *Neolestes* in the Malaconotinæ, and Sclater,³ in Shelley's 'Birds of Africa,' inserts it between *Malaconotus* and *Telophorus*, the latter a group of green-backed Shrikes referred by Reichenow to *Pelicius* and *Chlorophoneus*. This association of *Neolestes* is plainly unnatural, and an extract from Cabanis' original description⁴ will show how the error came about. "It belongs to none of the known genera, and its insertion in the classification is rather difficult. For the present it had best be considered, like *Calicalicus* for example, as an aberrant form of the Malaconotinæ, and be placed in the neighborhood of that genus."

The specimens of *Calicalicus madagascariensis* I have examined in the Philadelphia Academy collection reminded me much more of the Paridæ than of any other family; they certainly bore no special resemblance to *Neolestes*. *Calicalicus* is placed by some writers in the Vangidæ, but this question I shall not attempt to settle. Beyond a doubt, Cabanis' opinion as to *Neolestes* belonging in the Malaconotinæ was based on a superficial resemblance to certain green-and-yellow Shrikes with black breast-bands, of which I have two species (*Chlorophoneus quadricolor* and *Pelicius zeylonus*) for comparison. The likeness is extremely faint, even the black band on the side of the head occupying an entirely different position, since in *Neolestes* it passes completely above the ear-coverts and in these Shrikes below them. Following up the question of coloration, we may note that the young of *Chlorophoneus dohertyi* is barred on the body⁵—a shrike character—whereas that of *Neolestes* is not thus marked but closely resembles the adult, as does the young of *Pycnonotus*.

The bill of these Shrikes is typical of the Malaconotinæ; that of *Neolestes* approaches the form seen in *Pycnonotus* (see Figs. 2 and 3) but is relatively even broader at the base, while the nasal operculum is better developed. The lengthened nuchal filoplumes, sometimes said to characterize the Pycnonotidæ, are almost completely lacking in our specimens of *Neolestes*, but this is of slight importance, for they are found in *Malaconotus* and even among some Ploccinæ as well developed as in many Bulbuls.

¹1914, 'Die Vögel,' II, p. 289.

²1903, 'Hand-List of Birds,' IV, p. 299.

³1912, 'Birds of Africa,' V, part 2, p. 405.

⁴1875, Journal für Ornithologie, p. 237.

⁵1902, Rothschild, Nov. Zool., Pl. ix.

The wing helps but little in our decision. Like both *Pycnonotidæ* and *Malaconotinæ*, *Neolestes* has it ten-primaried and rounded. In *Pycnonotus* the fifth and sixth primaries (counting from inside) are longest, in *Neolestes* the sixth, in *Pelecinus* sixth and seventh. In the adult of *Neolestes* the tenth primary is relatively shorter than in *Pycnonotus tricolor*, but this in turn has it shorter than in *Pelecinus*. The foot of *Neolestes* is not at all shrike-like. The metatarsus is too short, and its scutellation not at all like that of *Pelecinus* and most *Laniidæ*, but much more similar to that of the *Pycnonotidæ*, though not so nearly "booted" as in *Pycnonotus*.

My first impressions in the field are thus confirmed. Although my judgment is based on external characters, for no anatomical material was preserved, *Neolestes* seems undoubtedly a *pycnonotid*. I believe, indeed, that its affinities are closer to *Pycnonotus* than to any other African genus of the family.

Now I find that all this has been anticipated by Dr. Gadow, as long ago as 1883, in Vol. VIII of the 'Catalogue of Birds in the British Museum.' Although retaining *Neolestes* in the *Laniidæ*, probably only for convenience, he clearly states in the introduction to that family that *Neolestes* and *Calicalicus* are so aberrant as to form links with the *Pycnonotinæ*. Furthermore, he appends to the Key to the Genera of *Malaconotinæ* (p. 103) a footnote which subsequent writers seem to have ignored almost completely, though it is well worth quoting here, since my present remarks are simply a confirmation of it.

Here may be mentioned *Neolestes* . . . which has been placed by Cabanis near *Calicalicus*; it does not appear to be a Bush-Shrike, but to be allied to the Bulbuls or *Pycnonotinæ*. Bill not laterally compressed, but considerably broader than high; genys decidedly curved downwards, and not upwards as in all *Laniidæ*; nostrils with a well developed coriaceous operculum; strong rictal bristles; tail rounded and slightly shorter than wings.

Such a critical examination of one genus of supposed Shrikes might well prompt one to ask "What of *Nicator*?" I well remember meeting for the first time in the field two species of this African genus, *N. chloris* and *N. vireo*, and my reluctance to place them among the *Laniidæ* has never been quite overcome. *Nicator*, of course, bears little resemblance to *Neolestes* and is undoubtedly more shrike-like, with the bill straighter, narrower, and distinctly hooked, the metatarsus long, the toes short. Yet here most of its shrike characters seem to end. I do not feel that the spotting of its wings and tail necessarily indicates a relationship with *Malaconotus*, but was at first tempted to associate it rather with *Bleda* among the *Pycnonotidæ*, which also has a straight compressed

bill with more or less of a hook. The feet of *Nicator* and *Bleda* are similar in proportions, though the metatarsus is scutellate in the first, practically booted in the second. Both genera have a peculiar gap in the feather tract of the back of the neck, and outer primaries of similar proportions.

At all events, I feel that *Nicator* is as near to the Pycnonotidæ as to any member of the Malaconotinæ, though perhaps belonging in neither of these groups. Attention may here be called to one peculiarity of

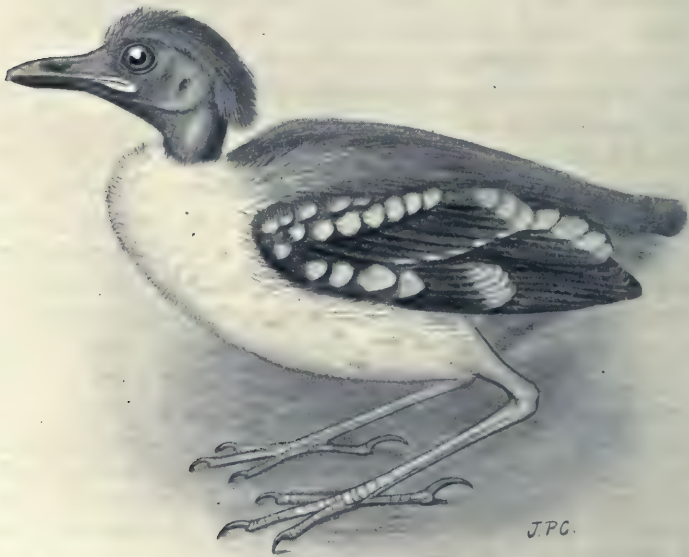


Fig. 5. Nestling of *Nicator chloris*, to show bare face and neck.
Natural size.

Nicator which is of interest. The true rictal bristles, in contrast to those of *Bleda*, are rather poorly developed and they are replaced functionally by a different group of feathers, situated much closer to the eye, the shafts of which are stiffened and prolonged, the barbs being greatly reduced. There is no approach to this in *Bleda*, and but little resemblance in *Malaconotus*.

The feathering of the nestling *Nicator* is very peculiar and quite different from that of any young Shrike (Fig. 5). At the time when the wings are half grown and the body already well feathered, the feathers of throat and cheeks, as well as those around the eyes, ears, and base of bill, have still failed to put in appearance and there is a broad median apterium running the whole length of the crown, of which no trace can be seen in the adult. The only feathers on the head are thus in two lateral lines on the crown, which join on the nape but are isolated from the spinal tract. The legs are entirely bare of feathers up to the lumbar tract and the appearance of such young birds is unique, the fluffy feathers of the upper breast forming a sort of ruff. I do not think that this is paralleled in *Bleda*, of which I have, however, seen no specimen quite young enough for comparison.

The juvenal plumage of *Nicator* is similar in color to that of the adult, whereas that of *Bleda syndactyla* and *eximia* is strikingly different, for the upperparts, excepting the remiges and rectrices, are mostly of a peculiar rufous or maroon, the underparts whiter; and this first plumage, which recalls that of *Turdinus* (Timeliidae), is molted even before the tail has attained its full length.

THE JUVENAL DRESS OF *SIGMODUS RUFIVENTRIS MENTALIS*

In glancing over our series of this bird from the Ituri and Uele, it is evident at once that immature examples are very differently colored about the head from adults, which have smooth bluish gray feathering on the crown and cheeks, set off sharply from the black collar encircling the whole neck. Instead, immature birds with black bills are found to have the lores and rictal bristles black, and a dark band extending from behind the eye to the nape, while the black collar does not encircle the foreneck.

A still younger individual, of female sex (A. M. N. H. No. 161114) with wings and tail fully grown, is seen to have a whitish collar extending almost entirely around the hind neck, and the cheeks and throat nearly white. The throat is separated from the purer white chest-patch by a narrow band of rufous crossing the foreneck. Even this specimen, however, has already begun to molt out of the juvenal plumage, for all its secondary coverts are black, and only a white spot at the tip of the second alula-quill gives a hint of their color in the first plumage.

Such a nestling as that shown in Figure 6 would be a puzzling bird to identify if we did not have some of the transitional stages. Most of the change to the adult plumage seems, nevertheless, to take place in a

single post-juvenal molt, which begins with the wing-coverts and is retarded longest about the head. Before the plumage of the head has been entirely renewed the molt of the remiges and rectrices is under way.

The young bird we figure (A. M. N. H. No. 161117, ♂) shows one peculiarity in which it is most unlike the Shrikes, though this genus and *Prionops* have very often been included in the Laniidæ. On the back of its crown there are two large bare patches of skin, separated by a narrow



Fig. 6. Nestling of *Sigmodus rufigentris mentalis*, with white wing-coverts and parietal areas of naked skin.

Colors of plumage largely blackish and white, as in the figure; but throat tinged with cinnamon, and lower breast, belly, and under tail-coverts pale cinnamon-rufous, very much lighter than in the adult. Natural size.

median line. Feathers will later grow from this skin, but they are always a little shorter there, a condition which aids in the sharp definition of the blue-gray cap in the adult.

What the difference in color-pattern between adult and young may mean we cannot be entirely certain, but it looks like a good case of recapitulation, an ancestral plumage appearing in the young only. The

adults of several species of the related genus *Prionops* have considerable white on the wing-coverts. As passerine families go, the Prionopidae seem to be well marked off from the true Shrikes; but the affinities to the two typical African genera of some of the other forms associated with them, as for instance in Sharpe's 'Hand-List,' seem to me most questionable.

THE SECOND KNOWN LOCALITY FOR *LECYTHOPLASTES PREUSSI*

The Cliff Swallow discovered by Preuss at the falls of the Sannaga, near Edea, Cameroon, and named in his honor by Reichenow,¹ has thus far never been reported elsewhere. It plastered its bottle-shaped nests, wrote Preuss, with flasklike necks pointing obliquely downward, in great colonies on the vertical cliffs, right below the waterfall; and there he caught as many as he liked with a butterfly net.

While making a journey from Faradje to Dungu, Upper Uele District, in 1911, I arrived on June 1 at the rest-house overlooking the River Dungu, about midway between the two posts and known as Gangara na Bodjo (= Bodjo's Hill). Flying about the huts and alighting on the bare ground around them was a flock of a dozen small swallows that looked new to me. I secured three, all adults, and was delighted to find that they resembled small Cliff Swallows, a group that I had not met thus far in the Congo. I recalled that in the preceding February, somewhere along this same part of the road, I had noticed some unusual swallows but thought at the time that they might be *Hirundo puella*. I am sure now that they were not.

At the time our specimens were taken they must have been breeding and were in worn plumage. The sexual organs of one male were noted as "much enlarged," those of the second as somewhat enlarged, and the ovary of the female slightly so. That they were not simply a wandering flock, far out of their normal range, is likewise indicated by my meeting a lone individual, on April 15, 1912, in the same general region, only about twenty-five miles to the south or southeast. To be more exact, it was a four hours' march west of the village of Gangura, an Azande chief, that this single bird was found, flying about near a strip of woods; but in shooting it I had the ill fortune to mutilate it beyond all usefulness. Though I twice had occasion to visit Gangara na Bodjo again, I never found the swallows there; their great rarity, or extremely local distribution, is attested by the fact that they have never been re-

¹1898, Orn. Monatsb., p. 115.

ported from any other localities than those above-mentioned, which are separated by a distance of 1300 miles. There can be no doubt of the breeding of Preuss' Swallow somewhere near the Dungu River, but just where we found it there seem to be no suitable cliffs at all. The only hill of any size I know in that vicinity is at Piagga, one day's march nearer to Faradje, where a splendid overhanging cliff was found in February 1913 to shelter a nesting colony of *Micropus affinis*. Yet no *Lecythoplastes* were observed; and on other higher hills near Aba, Garamba, Gangura's, Nzoro, and Dungu, only *Hirundo puella* and *Riparia rufigula* were found occupying the cliffs.

In view of the great distance from the type locality, the natural impulse is to look for slight differences in characters, but I can find none whatever. Reichenow's description fits exactly, even to measurements. Those of our specimens are: wing, ♂, 97, 96, ♀ 96; tail, middle feathers, ♂, 42, 42.5, ♀, 42; outer rectrices, ♂, 53, 53.5, ♀, 53; exposed culmen, ♂, 6.6, 6.2, ♀, 6.8; metatarsus, ♂, 10.3, 11, ♀, 10. The sexes do not differ any more in color than in size; one of our birds lacks the white spots on the outer pair of rectrices, but it is a male.

EASTERN LIMITS OF DISTRIBUTION FOR SOME WEST AFRICAN BIRDS

Collections made in recent years in Central Africa have shown repeatedly how many characteristic West African species extend their range from the Cameroon all across the Congo forests and even to the Lake Region. The number of such forest birds that have been taken near Beni, on the eastern border of the Belgian Congo, is surprising; and Dr. V. G. L. van Sonieren has recently made notable additions to the Uganda avifauna of species previously known only from West Africa.

A certain number of specimens in our Congo collection, representing West African forms that were not previously known to range so far into the Northeastern Congo or have been perhaps only once recorded from that part of the colony, are worthy of mention here.

Canirallus oculus ([Temminck] Hartlaub)

4 ♂, 2 ♀, Gamangui (Ituri); 1 ♀, Medje (Ituri); 2 ♂, 1 ♀, Niapu (Bomokandi).

Podica senegalensis senegalensis (Vieillot)

1 ♂ im., 1 ♀, Panga (Aruwimi R.); 1 ♂ with gray throat, 3 ♀, Avakubi (Ituri); 1 juv., Niapu (Bomokandi); 1 ♀ im., Niangara (Uele). Already recorded by Dubois¹ from Panga.

Lamprolaima rara Rothschild, Hartert and Kleinschmidt

1 ♀, Avakubi; 1 ♂, Niapu.

¹1905, Ann. Mus. Congo, Zool., (4) I, fasc. 1, p. 24.

Lamprolaima olivacea olivacea Du Bus

1 ♂, Avakubi.

Tigriornis leucolopha (Jardine)

1 ♂, 1 ♀, Gamangui; 1 ♂, Medje; 2 ♂, 1 ♂ juv., Niapu.

Urotriorchis macrourus ([Temminck] Hartlaub)

1 ♀ im., Avakubi. Dubois has already reported it from Banalia.

Astur castanius (Bonaparte)1 ♂, Gamangui; 2 ♀ im., Medje. The recently described *Accipiter beniensis* Lönnberg is apparently synonymous.*Accipiter sharpei* Reichenow1 ♂, Bengamisa (R. Lindi); 1 ♂, 1 ♂ im., Banalia; 1 ♀ im., Bafwasende (R. Lindi); 1 ♂, Avakubi. I consider *Accipiter zenkeri* and *A. erythropus*, which has recently been reported by Sassi from Beni, to be probably the immature stages of *A. sharpei* and *A. hartlaubi*. In such a case the name *sharpei* would be antedated by *zenkeri*.*Hieraaetus africanus* (Cassin)

1 ♀, 1 ♀ juv., Niapu.

Dryotriorchis batesi Sharpe

1 ♂, Stanleyville; 6 ♂, 3 ♀, Avakubi; 1 ♀, Medje; 1 ♀, Niapu; 1 ♀, Akenge (Bomokandi).

Baza cuculoides (Swainson)

1 ♂, 2 ♀, 2 ♀ im., Avakubi; 1 ♀ im., Ngayu (Ituri); 1 ♂, Rungu (Bomokandi). There is one previous record from Semio (N. Uele).

Scotopelia bouvieri Sharpe

2 ♂, 1 ♀, 1 ♀ juv., Niapu; 2 ♀, Niangara.

Bubo poënsis Fraser

2 ♂, 1 ♀, Avakubi; 1 ♂, Medje.

Bubo leucostictus [Temminck] Hartlaub.

1 ♂, Batama (Distr. Stanley Falls); 1 ♀, 1 ♀ juv., Medje. Recorded from Popoi (Aruwimi R.) by Dubois.

Glaucidium tephronotum Sharpe (= *G. pycrafti* Bates)

2 ♂, 1 ♀, Medje; 1 ♀, Nala (Bomokandi).

Otus holerythrus (Sharpe)

1 ♀ juv., Medje. Previously known from Banalia.

Scotopelia brunneiceps Sharpe

2 ♂, Avakubi.

Meropogon breweri Cassin

1 ♀, Banalia. Reported from Ubangi R. by Reichenow, and "Province Orientale" by Dubois.

Caprimulgus batesi Sharpe1 ♂, 1 ♀, 1 ♂ juv., 2 ♀ juv., Medje; 1 ♀, Avakubi. Bannerman¹ has reported it from Poko (Bomokandi).*Chætura cassini* Selater

1 ♂, Bengamisa; 3 ♂, 1 ♀, Avakubi; 2 ♂, 1 ♀, Ngayu; 1 ♂, Medje.

A single specimen recorded as *C. brevicauda* from Moëra by Sassi, also noted from Aruwimi R. by Reichenow, and from Poko, Uele Distr., by Bannerman.¹1919, Bull. Brit. Orn. Cl., XXXIX, p. 96.

Centropus anselii Sharpe

1 ♀, Isangi (mouth of R. Lomami).

Verreauxia africana (Verreaux)

1 ♂, Stanleyville; 3 ♂, 3 ♀, 2 ♂ im., 1 ♀ im., Avakubi.

Hirundo nigrita G. R. Gray

1 ♀, Bengamisa; 1 ♂, Banalia; 3 ♂, 2 ♀, 1 ♀ juv., Avakubi; 2 ♀, Gamangui; 2 ♂, Bafwabaka (Nepoko R.); 1 ♂, 1 ♀, Rungu; 1 ♀, Nzoro (Upper Kibali R.). Already reported in 'Vögel Afrikas' from Bafwazabangi, on Ituri R. and from the Aruwimi.

Fraseria ocreata (Strickland)

1 ♂, Avakubi; 1 ♂, Ngayu; 1 ♂, 1 ♀, Gamangui; 1 ♀, 2 ♂ im., Medje.

Fraseria cinerascens Hartlaub

1 ♂, Avakubi.

Lobotus oriolinus Bates

1 ♂, Medje.

Bæopogon clamans (Sjöstedt)

3 ♂, 2 ♀, Avakubi; 1 ♂, 1 ♂ im., Ngayu.

Camaroptera superciliaris (Fraser)

1 ♂, Avakubi; 1 ♂, Penge (Ituri); 1 ♂, Ngayu; 2 ♂, 1 ♀, 1 ♂ im., Medje; 1 ♀ im., Rungu.

Chaunonotus sabinei (J. E. Gray)

1 ♂, Avakubi; 1 ♂ im., Ngayu.

Cinnyris johannæ Verreaux

1 ♂, Dobo (Distr. Bangala); 1 ♂, Avakubi.

Anthreptes aurantium Verreaux

1 ♀, Stanleyville; 1 ♂, Panga (Aruwimi R.); 1 ♂, Bomili (Ituri); 5 ♂, 3 ♀, Avakubi; 1 ♂, 1 ♀, Gamangui; 1 ♂, Gada R. near Niangara (Uele). Ubangi R. and Yambuya on lower Aruwimi mentioned in 'Vögel Afrikas.'

Parmoptila jamesoni (Shelley)

2 ♂, 1 ♀, 3 ♂ im., Avakubi; 1 ♂, Babeyru; 1 ♂, 1 ♀, Gamangui; 1 ♀, 1 ♀ im., Medje. Type locality: Yambuya, lower Aruwimi R.

Hypargos dybowskii (Oustalet)

1 ♀, Faradje; 1 ♂, 2 ♀, Aba (Upper Uele). Type locality: Kemo, Ubangi R.

Estrilda melpoda (Vieillot)

3 ♀, Stanleyville; 2 ♂, 2 ♀, Panga. Recorded from Banalia by Dubois.

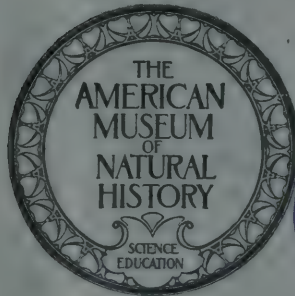
Brachycopa anomala (Reichenow)6 ♂, 1 ♀, Avakubi. Type locality: Stanley Falls. Extends up the Aruwimi and Ituri rivers, also down the Congo to Nouvelle Anvers. Recorded by Reichenow¹ from Banalia.¹1910, Vogelf. Mittelafr. Scengebietes, p. 326.

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DESCRIPTIONS OF PROPOSED NEW BIRDS FROM COLOMBIA, ECUADOR, PERU, AND BRAZIL

BY FRANK M. CHAPMAN



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DESCRIPTIONS OF PROPOSED NEW BIRDS FROM COLOMBIA, ECUADOR, PERU, AND BRAZIL

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As a result of studies made at the British Museum in parts of May and June of the present year, the author can now propose definite names for a number of birds which, pending comparison with authentic material, had been provisionally identified.

There are also here included descriptions of apparently new birds discovered by our recent Anthony-Cherrie Expedition to Ecuador, and of a *Leptasthenura* from Peru which I am permitted to name by the authorities of the British Museum. I am under deep obligation to these gentlemen, and particularly Dr. Percy R. Lowe, in charge of the Bird Department, for extending to me every facility to prosecute my labors while the guest of their institution. I wish also to thank Mr. Charles Chubb for his invaluable coöperation.

Nothocercus fuscipennis, new species

SPECIFIC CHARACTERS.—Throat white, forehead russet, as in *N. julius*; back and flanks finely vermiculated, as in *N. nigricapillus*; differing from both *julius* and *nigricapillus* in entire absence of markings on wing-quills.

TYPE.—No. 109,378, Amer. Mus. Nat. Hist.; ♀; Andes west of Popayan, Colombia; alt. 10,340 ft.; July 21, 1911; W. B. Richardson.

DESCRIPTION OF TYPE.—Upperparts and wing-coverts between Prout's and mummy-brown, finely and evenly vermiculated with black, the black markings broader on the rump, upper tail- and greater wing-coverts; anterior half of crown and loreal region russet grading into dark clove-brown very finely and faintly marked with russet on the hind head and cervix; ocular and postocular region with the tawny marks more pronounced; tail dark fuscous with a terminal fringe of the color of the back; wing-quills uniform dark fuscous wholly unmarked; throat and chin snowy white sharply defined from the pale sepia foreneck; rest of underparts mainly ochraceous tawny, the breast darker, the sides, flanks, tibiae and under tail-coverts much like the back and all finely vermiculated with black; feet brownish black; maxilla blackish, mandible Naples-yellow, brownish on its cutting edge and terminally. Wing, 180; tail, 50; tarsus, 61; culmen, 33 mm.

SPECIMENS EXAMINED

Nothocercus fuscipennis.—COLOMBIA: Andes west of Popayan, the type; Prov. of Cauca, 1 (in Brit. Mus.).

Nothocercus julius julius.—COLOMBIA: Bogotá, 3; Laguneta, 1; Almaguer, 1. ECUADOR: Pichincha (Goodfellow), 1 (in Brit. Mus.); 'Ambato,' 1.

Nothocercus julius salvadorii.—The type (in Brit. Mus.) labelled by Verreaux "Equateur" but probably not from Ecuador.

Nothocercus nigricapillus.—BOLIVIA: Locotal, 5800 ft., 1 ♀ im.

Comparison of the single specimen from the Western Andes, provisionally referred to *julius*,¹ with a series of that species representing every age from the lately hatched chick to maturity, convinces me of the specific distinctness of the west Colombian bird. Furthermore, a specimen in the British Museum labelled "Prov. of Cauca," the region whence the supposed new bird comes, shows its characters. Apparently *julius* always has the upperparts broadly barred with black and the outer web of the secondaries marked with cinnamon at all ages, whereas in *fuscipennis* the back is vermiculated, the wing-quills unmarked.

It is important to observe that *julius julius* ranges into Ecuador, a specimen from Pichincha in the British Museum, and one received through Ambato in the American Museum being referable to that species. The Ambato specimen was received in a small collection containing a specimen of *Osculatia sapphirina* and doubtless came therefore from the Amazonian slopes near Baños, perhaps therefore from the same region whence came three females referred by Taczanowski and Berlepsch to *julius* (Proc. Zool. Soc., 1885, p. 112) with the comment that the upperparts are darker, more olive and with broader bars, etc., differences which are shown by our Ambato bird and which may be of racial value.

Specimen "h" of the 'Cat. Birds Brit. Mus.' (XXVII, p. 510) commented upon by Salvadori and later described by Chubb as *Nothocercus julius salvadorii* (1914, Bull. B. O. C., XXIII, p. 95) differs from *julius* in its much more pronounced bars on back and wings, and is certainly not the same as our Ambato bird. It is labelled, evidently by Verreaux, "Equateur" but quite probably did not come from that country since it does not agree with specimens from either the Pacific or Amazonian side of the Andes.

An immature female from Locotal, Prov. Cochabamba, Bolivia, agrees with the description of *Nothocercus nigricapillus* supposed to have come from Chile. If this identification be correct, it affords us a clue to the range of this species.

I append a key to the members of this genus.

Throat white.

Crown wholly plumbeous.....*N. nigricapillus* (Gray).

Crown anteriorly russet.

Back strongly barred.

Secondaries barred only on outer web.. *N. julius julius* Bonaparte.

N. julius venezuelensis Cory.

¹1917, Bull. Amer. Mus. Nat. Hist., XXXVI, p. 190.

- Secondaries barred on both webs. *N. julius salvadorii* Chubb.
 Back finely vermiculated. *N. fuscipennis* Chapman.
 Throat ochraceous.
 Throat bright ochraceous.
 Greater under wing-coverts barred. *N. bonapartei bonapartei* (Gray).
 Greater under wing-coverts not barred. *N. bonapartei frantzii* (Lawrence).
 Throat pale ochraceous; underparts less rufous.
N. bonapartei intercedens Salvadori.

***Penelope barbata*, new species**

SPECIFIC CHARACTERS.—Similar to *Penelope argyrotis* Bonap. but much darker throughout, the chin and upper throat feathered, wholly concealing the skin; whitish margins to feathers gray instead of silvery white and, both above and below, confined to the anterior parts of the body, on the wings appearing only as very slight and inconspicuous markings on the lesser coverts; rump, upper and under tail-coverts and flanks cinnamon-brown instead of Sayal to Mikado-brown.

TYPE.—No. 156,201, Amer. Mus. Nat. Hist.; ♀ ad.; Taraguacocha, Zaruma-Zaraguro trail, Cord. de Chilla, Prov. del Oro, Ecuador; alt. 9750–11,000 ft.; Geo. K. Cherrie.

DESCRIPTION OF TYPE.—Crown and anterior parts of the back very dark olive laterally margined with gray, the forehead, superciliary, cheeks and sides of neck largely grayish; whole orbital region to the base of the bill bare, black in dried skin (blue in life ?); center of back and wings externally uniform shining olive-brown unmarked; rump and upper tail-coverts bright snuff-brown to warm sepia; tail externally like the middle back, lateral feathers black, all tipped with light cinnamon-brown decreasing in extent from without inwardly; chin and upper throat covered with black feathers with a slight mixture of gray posteriorly, concealing the skin; lower throat bare, except for a few short hair-like and slightly pinnate feathers; breast blackish, laterally margined with gray; abdomen light cinnamon-brown faintly vermiculated with blackish; lower tail-coverts darker; tibiae olive-brown, the feathers extending to the proximal third of the tarsus; feet reddish, bill black (skin). Wing, 250; tail, 250; tarsus, 59; culmen, 30 mm.

SPECIMENS EXAMINED

Penelope barbata.—ECUADOR: Taraguacocha, 1, the type; San Lucas, Pacific slope, 2 (Brit. Mus.).

Penelope argyrotis.—VENEZUELA: Merida, 1; Venezuela, 1, type of *P. lichtensteini* (Brit. Mus.). COLOMBIA, 1.

The type of this proposed species agrees with the two San Lucas, Ecuador, skins recorded by Mr. Ogilvie-Grant in the 'Cat. Birds Brit. Mus.,' XXII, p. 502 and believed by him to be probably the young of *Penelope argyrotis* of Venezuela. Comparison of the three with two Venezuelan and one Colombian example of that species demonstrates, in my opinion, the specific distinctness of the Ecuadorian form.

***Siptornis wyatti æquatorialis*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Siptornis wyatti wyatti* but all the dark areas above, including the central tail-feathers, much blacker, the feathers of the back margined with grayish instead of with brownish.

TYPE.—No. 124,504, Amer. Mus. Nat. Hist.; ♂ ad.; Mt. Chimborazo, Ecuador; alt. 13,000 ft.; July 3, 1913; W. B. Richardson.

SPECIMENS EXAMINED

Siptornis wyatti æquatorialis.—ECUADOR: Chimborazo, 3 ♂, 3 ♀; Cechce, 1 ♂.

Siptornis wyatti wyatti.—COLOMBIA: Paramo of Pamplona, 1 ♂ (type); Paramo of Chiruqua, 1 ♂, 1 ♀; Sierra Nevada of Sta. Marta; alt. 10,000–12,000 ft., 2 ♂, 1 ♀.

I have long suspected that the bird recorded as "*Siptornis wyatti*" from Ecuador probably did not agree with that form but, in the absence of authentic specimens of *wyatti*, it was not possible to reach a satisfactory conclusion in regard to the status of the Ecuador bird. Comparison of Ecuador specimens with the type, and apparently only specimen of *wyatti*, shows the differences given above and a further comparison with material from the Santa Marta group indicates that the bird from that region is essentially identical with *wyatti*. That the differences between the Ecuadorian and Colombian birds are not due to any post-mortem change in the color of the plumage is proven by the fact that one of the Ecuador specimens collected by Stolzmann at Cechce, May 18, 1883, is sufficiently old to be comparable with the type of *wyatti* collected in 1870, and specimens from Santa Marta collected in 1879 and 1881. On the other hand, specimens of *wyatti* collected in the Paramo of Chiruqua, Santa Marta, by Carriker in 1914, are comparable both as to condition of plumage and age of skin with our Ecuadorian series of *æquatorialis*. The Cechce specimen in the British Museum (specimen "f" in 'Cat. Birds Brit. Mus.,' XV, p. 71) above referred to bears the MS. name "*Synall. paramo* sp. n. type de la description pour M. Selater," but I cannot find that this name was published.

***Odontophorus parambæ canescens*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Odontophorus parambæ parambæ* Roths., but prevailing color of the upperparts grayish rather than rich brownish, the black areas smaller, the markings on wing-coverts and tertials buffy rather than ochraceous; size much larger, the bill longer and notably thicker.

TYPE.—No. 156,205, Amer. Mus. Nat. Hist.; ♂ ad.; Alamor, Prov. Loja, Ecuador; alt. 4500 ft.; October 3, 1920; Geo. K. Cherrie.

SPECIMENS EXAMINED

Odontophorus parambæ canescens.—ECUADOR: Alamor, 2 ♂ (inc. type).

Odontophorus parambæ parambæ.—ECUADOR: Esmeraldas, 1 ♂; Naranjo, Prov. Guayas, 2 ♀; near Zaruma, Prov. del Oro, 2 ♂, 1 ♀. COLOMBIA: Barbacoas, 1 ♀; Baudo, Chocó, 2 ♂.

MEASUREMENTS

	Sex	Wing	Tail	Tarsus	Culmen	Depth of Bill at Base
Alamor, Ec.	♂	153	61	36	20.5	13
" "	♂	145	58	38	20	13
Esmeraldas, Ec.	♂	130	..	35	18	11.5
Barbacoas, Col.	♀	135	49	35	18.5	11.5
Baudo, "	♂	130	50	35	18	10.5
Naranjo, Ec.	♀	134	55	38	19	12
Zaruma, "	♂	144	57	37	20	13
" "	♀	144	..	37	19.5	13

Odontophorus parambæ occurs in both the Tropical and Subtropical Zones of the Pacific coast of Ecuador and Colombia, from the Peruvian boundary at least to the Chocó. From the last-named region to northern Ecuador it shows no apparent geographical variation. Naranjo specimens are slightly larger while those from near Zaruma exhibit a further approach toward *canescens*, not only in size but in their grayer color. They are, indeed, so nearly intermediate between the small dark northern race and the large pale southern one that it is difficult to say to which they should be referred. Our series therefore indicates the complete intergradation of these two well-marked races.

***Nyctibius longicaudatus chocoensis*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Nyctibius longicaudatus longicaudatus*, but general coloration much deeper, the black markings of the upperparts more extensive and more pronounced, the crown largely black, the back and scapulars with sharply defined black shaft-streaks, the brown areas of the upperparts darker, chestnut rather than ochraceous.

TYPE.—No. 111,501, Amer. Mus. Nat. Hist.; ♂ ad.; "testes slightly enlarged"; Nóvita, Rio San Juan, Chocó, Colombia; alt. 400 ft.; December 23, 1911; Allen and Miller.

SPECIMENS EXAMINED

COLOMBIA: Nóvita, 1 ♂ (the type), 1 ♀. BRAZIL: 1. BR. GUIANA: Bartica Grove, 1 ♀. ECUADOR: Sarayaçu, 3.

Comparison of the two specimens of *Nyctibius*, which, for lack of material, I provisionally referred to *longicaudatus* in my paper on Colombian birds,¹ with examples of this species in the British Museum shows, as might be expected, that the bird from the intensely humid Chocó region of Colombia proves to be a well-marked form. The capture

¹1917, Bull. Amer. Mus. Nat. Hist., XXXVI, p. 272.

of these specimens extends the known range of *Nyctibius longicaudatus* west of the Andes to the Colombian-Pacific Fauna.

***Picumnus parvistriatus*, new species**

SPECIFIC CHARACTERS.—Similar to *Picumnus sclateri* Tacz., but underparts much less heavily marked with black, the breastbars decidedly narrower than the white ones, the streaks of the abdomen and flanks comparatively obsolete; white crown-spots larger.

TYPE.—No. 124,368, Amer. Mus. Nat. Hist.; ♂ ad.; Daule, Prov. Guayas, Ecuador; W. B. Richardson.

DESCRIPTION OF TYPE.—Crown black, the feathers with large rounded tips, yellow on the forehead, white on the remainder of the crown; back pale buffy brown, faintly margined with lighter; tail black, the central feathers white on the inner web; outer feathers with a subapical, diagonal white band; wings fuscous, the inner feathers exteriorly margined with olivaceous; sides of the head white faintly banded with blackish, extending narrowly to the nape; throat and breast banded with black and white, the white bands being pronouncedly broader than the black ones; abdomen and flanks white, narrowly and obscurely striped with blackish; feet and bill blackish. Wing, 52; tail, 25; tarsus, 12; culmen, 12 mm.

DESCRIPTION OF FEMALE.—Similar to male but spots on forehead white instead of yellow. Wing, 51; tail, 24.5; tarsus, 12; culmen, 12 mm.

DESCRIPTION OF IMMATURE.—Similar to the adult female but the crown striped instead of spotted.

SPECIMENS EXAMINED

Picumnus parvistriatus.—ECUADOR: Daule 1 ♂ (type); Manta, Prov. Manaví, 1 ♀; Guayaquil, 1 im.

Picumnus sclateri.—PERU: Paletillas, Prov. Piura, 1 ♂, 2 ♀. ECUADOR: Alamor, Prov. Loja, 4550 ft., 1 ♂ im.; Portovelo, Prov. del Oro, 2000 ft., 1 ♀; Salvias, Prov. del Oro, 3600 ft., 1 ♂; Rio Pindo, Prov. del Oro, 1850 ft., 1 ♂; Santa Rosa, Prov. del Oro, 1 ♀.

The form here described is obviously a representative of *Picumnus sclateri* but the character and extent of its differentiation from that species indicate its specific distinctness. The range of *P. sclateri* appears to be the Tropical Zone of southwestern Ecuador and extreme northwestern Peru. Our eight specimens, which represent the larger part of this area show no racial variation, the most northern being no nearer *parvistriatus* than the most southern. Similarly, our specimens of the last-named form, which inhabits semiarid Ecuador from Guayaquil at least to Manta and probably Bahia de Caraque, are uniform in color.

***Thamnophilus zarumæ*, new species**

SPECIFIC CHARACTERS.—Similar to *Thamnophilus radiatus radiatus* Vieill., but smaller, the male above and below more narrowly barred, the bars obsolete on the nape; forehead with more white, lateral crest feathers with white markings; abdomen

and flanks buffy and comparatively unbarred; inner webs, of all but one outer and two or three inner wing-quills, with even margins instead of spots; under wing-coverts buffy. Female less clearly rufous above than the female of *radiatus*, the nuchal region grayish olivaceous, the sides of the head, especially posteriorly, with little or no buffy wash; the underparts much paler.

TYPE.—No. 129,684, Amer. Mus. Nat. Hist.; ♂ ad.; Zaruma, Prov. del Oro, Ecuador; September 17, 1913; W. B. Richardson.

DESCRIPTION OF MALE.—Cap black, the forehead thickly spotted with white, all but the central feathers of the elongated crown feathers spotted with white on one or both webs; nape blackish, barred or spotted with white, the post-nuchal region grayish, the bars obsolete; back with black and white bars, the former the wider; upper tail-coverts tipped with buffy; tail black with a subterminal white bar, on at least the central feathers, and broken white bars on both webs of all of them; wings black, the outer webs of the feathers with white spots, not reaching to the shaft, the secondaries and tertials tipped with white, the latter marked with white on both webs; the inner margins of secondaries and all but outer primary, with even, well-defined white margins, which, on the inner secondaries, reach the white terminal margin and, basally, the shaft of the feather; upper wing-coverts subterminally barred, and laterally spotted with white; under primary-coverts white narrowly tipped with black, under secondary coverts buffy; sides of the throat striped black and white, lores and auriculars grayish white; throat white faintly streaked with black; breast and sides white narrowly and not continuously barred with black; abdomen centrally white becoming buffy posteriorly and on the flanks and under tail-coverts; the bars on the abdominal region obsolete or wanting; tibiae barred with black and white; feet blackish, bill blackish, tomiae and mandible horn-color. Wing, 66-69; tail, 64-67.5; exposed culmen, 15-17 mm.

DESCRIPTION OF FEMALE.—Crown rufous-chestnut; forehead buffy, chiefly basally; anteorbital region pale buffy; post-orbital region whitish striped with black; back hazel, grayish olivaceous anteriorly with an ill-defined grayish nuchal band; tail deep ferruginous-hazel; wings blackish, exteriorly like the tail, internally margined with ochraceous-buff, the inner feathers sometimes obsoletely barred; upper wing-coverts like the tail, darker centrally and with a paler subterminal band and narrow black margin; under wing-coverts ochraceous-buff; throat whitish, obscurely streaked; rest of underparts ochraceous-buff, darker on the flanks and ventral region, paler centrally; the breast with a faint suggestion of dusky bars; feet and bill as in the male. Wing, 64-70.5; tail, 62.5-71; exposed culmen, 16-18 mm.

SPECIMENS EXAMINED

Thamnophilus zarumæ.—ECUADOR: Zaruma, 6000 ft., 2 ♂ (inc. type), 4 ♀; Portovelo, 2000-2700 ft., 5 ♂, 3 ♀; Rio Pindo, 1850 ft., 1 ♀; Punta Santa Ana, Prov. del Oro, 4000 ft., 1 ♂, 2 ♀; Celica, 6900 ft., Prov. Loja, 1 ♀; Alamor, Prov. Loja, 4350 ft., 1 ♂, 1 ♀. PERU: Milagros, 2200 ft., Prov. Piura, 1 ♂.

Thamnophilus radiatus albicans.—COLOMBIA: Bogotá region, 9 ♂, 8 ♀.

The discovery of a representative of *Thamnophilus radiatus* on the Pacific coast of southwestern Ecuador is of exceptional faunal interest. No other form of this group is known from either western Ecuador or western Colombia and the species here described falls into

the list of species represented at the eastern and western bases of the Ecuadorian Andes, with no connection of range. The new bird also adds one more species to the list of those restricted to southwestern Ecuador and the immediately contiguous part of Peru.

The abundance and nature of my material proves beyond question that the characters which distinguish this proposed new form are not attributable to immaturity and the characters themselves are obviously of specific value.

THE STRIPE-BACKED MEMBERS OF THE GENUS *Leptasthenura*

Comparison of the specimen of *Leptasthenura*, provisionally referred to *pileata* Sel. in Bull. 117 U. S. Nat. Mus., p. 82, with the type of that species shows at once that the Torontoy bird is specifically distinct, and I therefore describe it below.

Leptasthenura xenothorax, new species

SPECIFIC CHARACTERS.—Most nearly related to *Leptasthenura pileata* Sel., but hazel-rufous of crown extending to interscapulars; a pronounced white postocular stripe; back much blacker, shaft-streaks whiter and narrower; throat conspicuously black and white, the sharply contrasting black margins of the feathers separated by the basal white, reaching along the shaft to the tip of the feather; remainder of underparts gray, unmarked and clearly defined from the throat area.

TYPE.—No. 273,010, U. S. Nat. Mus.; ♂ ad.; Torontoy, Urubamba Valley, Peru; alt. 14,100 ft.; May 14, 1915; E. Heller.

DESCRIPTION OF TYPE.—Entire crown and nape uniform hazel-rufous, unstreaked; lores blackish; postocular stripe white; center of back black with sharply defined white shaft-streaks; back anteriorly brown; the shaft-streaks more rufous and less clearly defined; tail blackish, the three outer feathers with grayish ends decreasing in extent from without inwardly; wings blackish; their coverts, inner quills, median portion of the external web of the inner primaries and basal portion of the external web of the secondaries cinnamon-buff; throat and sides of the neck conspicuously jet black and snowy white, the sharply contrasting black margins of the feathers separated by the arrow-shaped white area, the point of which extends along the shaft to the tip of the feather; remainder of the underparts uniform smoke-gray with a drab tint. Wing, 66; tail, 77; tarsus, 21; culmen, 10 mm.

I found also in the British Museum a specimen of what is evidently *Leptasthenura striata* Ph. and Land., from Iquique not far south of Arica, the type locality of this apparently rare and little known species. A specimen in the American Museum, collected by Beck at Lima, is apparently also to be referred to *striata* though it was not compared with the Iquique example. Compared with the latter, the type of *pileata* has the crown solid rufous unstriped, the shaft-streaks of the back and throat-spots more pronounced, the breast and belly dusky olive, the former with broad, the latter, with narrow but well-defined central streaks.

Four specimens in the British Museum, collected by Baron in the Temperate Zone of northern Peru, apparently represent *striata*, the coastal form, but are at least subspecifically and perhaps specifically separable from it. I suggest for this apparently undescribed form the name

***Leptasthenura striata cajabambæ*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Leptasthenura striata striata* Ph. and Landb. of northern Chile, but rufous of crown deeper, dorsal stripes whiter, throat-spots more numerous and more pronounced. Wing-quills and coverts margined with grayish instead of cinnamon; cinnamon band at base of inner quills much narrower and paler; margins to tail feathers grayer.

TYPE.—Registry No. British Museum, 99-6, 1, 81; ♀; Cajabamba, Peru; alt. 9500 ft.; March 28, 1894; O. T. Baron.

SPECIMENS EXAMINED

Leptasthenura xenothorax.—PERU: Torontoy, the type.

Leptasthenura pileata.—PERU: Andes of Lima (type, Brit. Mus.).

Leptasthenura striata striata.—CHILE: Iquique, 1 (Brit. Mus.). PERU: Lima, 1 ♂ (Amer. Mus.). These two specimens were examined independently.

Leptasthenura striata cajabambæ.—PERU: Cajabamba, alt. 9500 ft., 1 ♀ (type, Brit. Mus.); Cajamarca, alt. 10,000 ft., 2 ♂; Huamachucho, 1 ♀.

The specimens on which this well-marked form is based were identified by Salvin as "*Leptasthenura pileata* Sel." (1895, Nov. Zool. II, p. 121). They differ, however, from that species in their striped crown and other characters.

The members of the genus *Leptasthenura* having the back streaked constitute a closely related group confined to the Andean Paramo, or Puna Zone, and to that portion of the Pacific coast washed by the Humboldt Current. So far as known, the group includes four species and four subspecies which may be diagnosed as follows:

Crown streaked.

Breast streaked.

Ecuador and Central Andes of Colombia (type locality, Panza, Ec.).

L. andicola andicola Sclater.

Peru (type locality, La Raya, south of Cuzco). *L. a. peruviana* Chapman.¹

Colombia (type locality, Paramo of Macotama, Sierra Nevada of Santa Marta). *L. a. extima* Todd.²

Colombia (type locality, Lagunillas, Boyaca). *L. a. exterior* Todd.³

¹1919, Bull Amer. Mus. Nat. Hist., XLI, p. 327.

²1916, Proc. Biol. Soc. Wash., XXIX, p. 97.

³1919, Proc. Biol. Soc. Wash., XXXII, p. 115.

Breast not streaked

Wings externally margined with grayish.

Peru (type locality, Cajabamba). *L. striata cajabambæ* Chapman.

Wings externally margined with cinnamon.

Coasts of northern Chile, and Peru (type locality, Arica). *L. striata striata* Philippi and Landbeck.

Crown not streaked.

Lower parts streaked.

Peru (type locality, Andes of Lima). *L. pileata* Sclater.¹

Lower parts not streaked.

Peru (type locality, Torontoy, Urubamba Cañon). *L. xenothorax* Chapman.

Automolus celicæ, new species

SPECIFIC CHARACTERS.—Not closely related to any recognized species of *Automolus*; possibly nearest *A. cervinigularis* but feathers of the crown less elongate and browner; underparts streaked, etc.; with a general resemblance to *Philydor temporalis* Sel., but bill much larger. Crown Brussels-brown instead of olive; throat washed with buff, sides of the neck clear ochraceous orange.

TYPE.—No. 22,115, Amer. Mus. Nat. Hist.; ♂ ad.; Celica, Prov. Loja, Ecuador; alt. 4550 ft.; September 25, 1920; George K. Cherrie.

DESCRIPTION OF MALE.—Upperparts ochraceous-tawny, whole crown slightly darker, Brussels-brown; a pronounced superciliary ochraceous-buff anteriorly, becoming ochraceous orange posteriorly where it meets the clear ochraceous orange of the sides of the neck and ill-defined nuchal band; anteorbital and postauricular regions grayish; tail clear, uniform, deep hazel; wings externally like the back; the quills blackish on the inner web margined with rich ochraceous buff; under wing-coverts ochraceous orange; throat buff to antimony-yellow, its sides and a suggestion of a gular band ochraceous orange; remainder of underparts isabella more tawny olive or tawny on the flanks; the breast-streaks like the color of the throat; lower tail-coverts cinnamon-rufous; feet blackish; maxilla blackish; mandible horn-color, except on tip and cutting edge. Wing, 85–89; tail, 73–78; culmen, 21.5–23 mm.

DESCRIPTION OF FEMALE.—Resembling the male in color but somewhat smaller in size. Wing, 80–84; tail, 69–75; culmen, 22 mm.

SPECIMENS EXAMINED

Automolus celicæ.—ECUADOR: Celica, 6 ♂ (inc. type), 2 ♀; Alamor, 2 ♀; Guachumaná, 4050 ft., 1 ♂.

Philydor temporalis.—ECUADOR: Pallatanga, the type; Alamor, 4550 ft., 1 ♀; El Chiral, 5350 ft., 1 ♀.

The discovery of this distinct species in the Alamor region further emphasizes the faunal characteristics of the southern end of the Pacific Subtropical Zone of Ecuador. In the character of its bill and feet *Automolus celicæ* agrees with other members of this genus, in its shorter,

¹1863, Arch. für Naturg., I, p. 119.

crown-feathers it is like the species of the genus *Philydor*, while in general coloration it more nearly resembles *Philydor temporalis* than any other species known to me.

***Pachysylvia fuscicapilla albigula*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *P. f. fuscicapilla* (Sel. and Salv.) but throat dusky white well defined from yellowish of the remaining underparts which are paler and less uniform than in *fuscicapilla*, the median line being whitish; upperparts as in *fuscicapilla*, the bill shorter; with a general resemblance to *P. semibrunnea* but smaller and with a shorter bill, the crown Saccordo's umber rather than hazel, this color extending further on the back; the breast without the buffy wash usually present in *semibrunnea*, the underparts with more yellow, the wing-coverts greener and nearly uniform without the narrow yellowish margin of *semibrunnea*. Wing, 56; tail, 41.5; culmen, 13 mm.

TYPE.—No. 11,033, Museum Goeldi; ♀; Sta. Julia, Rio Iriri (branch of the Xingu), Brazil; April 17, 1914; Emilia Snethlage.

SPECIMENS EXAMINED

Pachysylvia fuscicapilla albigula.—BRAZIL: Rio Iriri, the type; Sta. Helena, Rio Jamauchim (branch of the Tapajoz), 1 ♂.

Pachysylvia fuscicapilla fuscicapilla.—ECUADOR: Sarayacu, 3 (inc. type; Brit. Mus.).

Pachysylvia semibrunnea.—COLOMBIA: Miraflores, Cen. Andes, 3 ♂, 1 ♀, 1 ?; Palmira, 1 ♀ ?; Aguadita, 1 ♂; 'Bogotá,' 1.

This proposed form is based on two birds contained in a small collection forwarded by Dr. Snethlage of the Goeldi Museum, identification of which was deferred pending examination of specimens in the British Museum.

***Basileuterus fraseri ochraceicrista*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Basileuterus fraseri fraseri* Sel., but with the center of the crown ochraceous-orange instead of lemon-chrome slightly tipped with chestnut.

TYPE.—No. 120,138, Amer. Mus. Nat. Hist.; ♂ ad.; Chone, Manaví, Ecuador; December 16, 1912; W. B. Richardson.

SPECIMENS EXAMINED

Basileuterus fraseri ochraceicrista.—ECUADOR: Chone, 2 ♂ (inc. type), 2 ♀; Guayaquil, 1 ♂; Puno Is., 1 ♀; Balzar, 2; Santa Rita, 1; Babahoyo, 1 (int.); Naranjito, 2 (int.).

Basileuterus fraseri fraseri.—ECUADOR: Pallatanga, 1 (the type); Prov. del Oro, Santa Rosa, 3 ♂, 2 ♀, 2 ?; Zaruma, 1 ♂; Portovelo, 2 ♂, 5 ♀, 1 ?; El Chiral, 5350 ft., 1 ♂, 1 ♀; Salvias, 3600 ft., 1 ♀; Alamor, Prov. Loja, 4550 ft., 2 ♂, 1 ♀.

Although the differences between the two races of *fraseri* here recognized might, at first glance, be considered attributable to age or

individual variation, the large amount of material examined and the fact that apparently a definite range can be given to each form, convinces me of their racial distinctness.

The yellow-crowned bird (*fraseri*) occurs in the humid forested region east of Puna Island and is found in the Subtropical as well as Tropical Zone. In the first-named zone it extends at least as far north as Pallatanga. The ochraceous-crowned bird (*ochraceicrista*) occupies the semiarid Tropical Zone from Puna Island and, on the mainland, from Guayaquil north to the Province of Manaví. Two specimens from Naranjito on the Guayaquil and Quito R. R., just west of Bucay where the continuous forest begins, are intermediate, the yellow bases to the coronal feathers being only partly, instead of wholly concealed by their ochraceous-orange tips.

***Sporophila insulata*, new species**

SPECIFIC CHARACTERS.—Resembling *Sporophila minuta*, but rump largely gray, only the most posterior feathers being chestnut, the tail-feathers basally white.

TYPE.—No. 118,142, Amer. Mus. Nat. Hist.; ♂ (ad. ?); Tumaco, southwestern Colombia; July 28, 1912; W. B. Richardson.

DESCRIPTION OF ADULT (?) MALE IN WORN PLUMAGE.—Upperparts, including upper tail-coverts, mouse-gray, only the terminal feathers of the rump rufous-chestnut; tail black, white at the base, white on the outer feathers much reduced or absent; wings black, secondaries white for basal half, all but two outer primaries basally white, increasing in extent inwardly; underparts rufous-chestnut, the abdomen mixed with whitish (indicating immaturity ?); the lower tail-coverts chestnut; bill and feet blackish. Wing, 50; tail, 36; culmen, 9.3 mm.

DESCRIPTION OF IMMATURE MALE IN WORN PLUMAGE.—Similar to adult, but abdomen and under tail-coverts white.

DESCRIPTIONS OF FEMALE IN WORN PLUMAGE.—Resembling female of *S. minuta* in comparable condition, but somewhat grayer above and paler below and with more white at the bases of the wing-quills. Wing, 48; tail, 36; culmen, 9.3 mm.

SPECIMENS EXAMINED

Sporophila insulata.—COLOMBIA: Tumaco, 1 ad. ♂ (type), 2 im. ♂, 1 ♀.

Sporophila minuta.—A large series from Nicaragua to Panama, Colombia, Venezuela, Trinidad and Brazil.

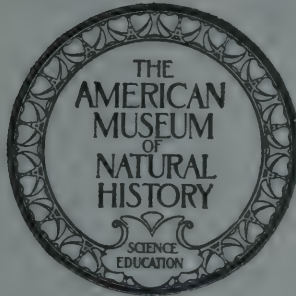
While apparently a representative of *Sporophila minuta*, the bird here described evidently deserves full specific rank. It is known as yet only from the island of Tumaco, but whether an island form or not, it appears to be insulated from its nearest relative, since our researches have thus far failed to discover any other representative of *Sporophila minuta* on the coasts of either Colombia or Ecuador.

AMERICAN MUSEUM NOVITATES

No. 19

NEW MAMMALS FROM BRITISH GUIANA
AND COLOMBIA

By H. E. ANTHONY



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NEW MAMMALS FROM BRITISH GUIANA AND COLOMBIA

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Through an arrangement with Mr. William Beebe, Director of the Tropical Research Station of the New York Zoological Society, The American Museum of Natural History has been receiving collections of mammals made in British Guiana, where the station is located. A report upon the combined collections is in process of preparation, but four new forms have been found and are described in this preliminary paper. In addition the description of a new rodent, of the genus *Dinomys*, from Colombia is included.

***Tayassu pecari beebei*, new subspecies**

TYPE.—No. 42408, Amer. Mus. Nat. Hist.; Kartabo, British Guiana; June 11, 1919; collector Wm. Beebe. The type is an adult female, with skull.

GENERAL CHARACTERS.—Closely related to *pecari pecari*, but differing in the extent of white on the snout and lower jaw.

DESCRIPTION.—Coloration about as in *p. pecari* but white of face and throat markings more yellowish; long hairs of upper parts brownish black; snout, above, only slightly lighter in color than rest of upper parts and not with strongly contrasting whitish of *p. pecari*; chin and throat patch restricted and not in such marked contrast to the surrounding areas; feet dark to hoofs. Skull as in *p. pecari*.

MEASUREMENTS.—Taken from animal in the flesh: total length, 1090 mm.; tail vertebrae, 60; hind foot, 224; weight, 80 pounds.

There are five specimens in the Kartabo series, two males and three females, and in no one of them is there the extensive face and throat patch seen in *p. pecari* collected at Porto Campo, Brazil. In all of them this area is noticeably less extensive and markedly more yellowish. The only specimen with the legs entire shows none of the whitish markings seen in *p. pecari* just above the hoofs. The Kartabo animal gives a strong impression of being unicolor and is not as contrastingly marked as the animals from Brazil.

Although the material for comparison is rather inadequate to show detailed differences, there being only three adult specimens of *p. pecari* from Brazil at hand, the color differences alone appear to be ample for the separation of a new race, which is named in honor of Mr. William Beebe, the director of the Tropical Research Station in British Guiana.

The series of *p. pecari*, collected in Colombia, Santa Marta district, and identified by Dr. J. A. Allen,¹ appear to be more or less intermediate

¹1904, Bull. Amer. Mus. Nat. Hist., XX, p. 427.

between true *pecari* and *p. beebei*, resembling the Brazilian series rather more than the specimens from Guiana.

With regard to the subspecies of *pecari* described from Ecuador by Lönnberg¹ as *æquatoris*, I am unable to state the characters by which it and the Guiana specimens may be differentiated, since I have not seen *æquatoris*, but the two races are separated by almost the width of a continent and the high ranges of the Andes, and it is unlikely that the two will prove to be identical. Lönnberg's type is an animal too young to reveal characters that may be accepted with certainty as those of an adult, and the restriction of the white snout and throat markings, in which it agrees with *beebei*, may well be one of the characters of immaturity.

Specimens of *pecari* obtained from the headwaters of the Rio Napo, in Ecuador, just east of the type locality of *æquatoris*, but across the Andes, certainly do not resemble *beebei* very closely in external characters.

NUMBER OF SPECIMENS.—Eight, 7 skins, 7 skulls, 2 skeletons, from Kartabo.

MEASUREMENTS OF SKULLS OF *Tayassu pecari pecari* AND *T. p. beebei*.

	Total Length	Basal Length	Zygomatic Breadth	Post-orbital Breadth	Upper Molar Series
<i>T. p. beebei</i>					
No. 42408 ♀ type	293	245	121	95	85
42409 sex?	300	250	124	100	79
42410 ♂	281	241	125	91	81
48366 ♀	273	230	120	87	74
<i>T. p. pecari</i>					
Average of 9 skulls from Santa Marta, Colombia	260	227	111	88.7	77
<i>T. p. pecari</i> —Brazil					
36655 ²	270	226	111	79	76
36656	280	235	114	91	80
36657	287	236	120	93	82

¹1921, Arkiv. för Zool. Stockholm, XIV, No. 4, p. 56.

²Last molar just through gum.

Pecari *tajacu macrocephalus*, new subspecies

TYPE.—No. 48366, Amer. Mus. Nat. Hist., old ♀, skin and skull; Kartabo, British Guiana; August 26, 1920; collector Wm. Beebe.

GENERAL CHARACTERS.—Similar to *tajacu* but with skull larger and markedly different in structure.

DESCRIPTION.—Pelage about as in *tajacu*, grizzled yellowish and black, with black dorsal area; collar fairly well outlined.

Skull larger than that of *tajacu*, with more massive build, the forward extension of the zygomatic flange continued to canine alveolus and forming a heavy rostrum; outline of entire skull noticeably subtriangular viewed either from above or below, due to extended zygomatic flange; palate throughout anterior portion wider than distance across the molar series of that portion.

MEASUREMENTS.—Taken in the flesh: total length, 948 mm.; length of hind foot, 195.

The Guiana collared peccary differs so from the collared peccary of Brazil and from *torvus* of Colombia that it is necessary to give it a new name. The skins of the new subspecies are not unlike those of either neighbor but the series of skulls shows differences too great and too constant to be overlooked. The subtriangular outline of the skull of *macrocephalus* is so unlike the outline of the skull of Brazilian *tajacu*, which is flask-like, that by this character alone the Guiana animal may be easily differentiated. There is an approach to this condition seen in the skulls of *torvus* from the Santa Marta district of Colombia but it is not so conspicuous. In *macrocephalus* the rostrum just anterior to the orbits is especially widened and built out. As may be noted from the table of measurements, the skulls of the new subspecies are larger than those of either *tajacu* or *torvus*.

The character of the anterior lower molar, given by Bangs in his description of *torvus*,¹ appears to have little value in separating *torvus* from *tajacu*, since in the series of skulls of these two forms now in the Museum's collection there are individuals of *tajacu* which have this tooth with the anterior tubercle two-lobed (a condition said by Bangs to be found only in *torvus*) and there are individuals of *torvus* having the tooth with the tubercle entire.

In the belief that more material from northeastern South America will eventually show *torvus* to be a subspecies of *tajacu*, I have made the Guiana animal a subspecies of *tajacu*, although it resembles *torvus* fully as much as it does *tajacu*.

NUMBER OF SPECIMENS.—Eight, as follows: Kartabo, 3 skins, 5 skulls; Kalacoon, 2 skins, 1 skull.

¹1898, Proc. Biol. Soc. Wash., XII, p. 164.

MEASUREMENTS OF SKULLS OF *P. t. macrocephalus*, *P. torvus*, AND *P. t. tajacu*.

	Greatest Length	Basal Length, foramen magnum to incisors	Zygomatic Breadth	Postorbital Breadth	Breadth of Rostrum	Depth of Occiput	Length of Upper Molar Series	Greatest Length of Mandible	Length of Lower Molar Series
<i>macrocephalus</i>									
41937	245	205	111	89	40	83	69	176	72
42407	256	208	109	77	38	89	67	177	71
48145	247	207 ³	109	82	39	82 ³	67	171	71
48223	246	203	104	77	39	88	64	174	71
48366 ¹	250	201	106	74	37	85	63	172	69
<i>torvus</i>									
14677 ²	240	197	103	75	41	82	67	168	74
<i>tajacu</i>									
330 ²	236	189	108	71	38	85	65	168	70

***Æcomys rutilus*, new species**

TYPE.—No. 42910, Amer. Mus. Nat. Hist., ♀ ad.; Kartabo, British Guiana; June 27, 1920; collector Wm. Beebe. The type is a skin with skeleton.

GENERAL CHARACTERS.—A small, brightly colored species, with very short tail and clear white under parts.

DESCRIPTION.—Color above, between amber-brown and hazel (Ridgway), darkest along dorsal area and on crown, the hairs slaty black for basal two-thirds; below, clear white, the hairs white to the base; hands and feet dirty white, almost dusky; dark orbital ring with small dark area at posterior corner of eye; tail brownish, unicolor. Skull small and broad, rostrum very short, zygomata flaring, a low supra-orbital beading.

MEASUREMENTS.—Taken in the flesh: total length, 171 mm.; tail vertebrae, 94; hind foot, 20. Greatest length of skull, 24.2; zygomatic breadth, 13.5; length of nasals, 7.7; interorbital breadth, 4.4; breadth of brain-case, 11; palate, to incisors, 10; palatal foramina, 3.7×2.2; length upper molar series, 3.4.

Compared with *Æcomys nitedulus*, collected at the same place, Kartabo, *rutilus* is somewhat smaller superficially, much brighter in color, with longer, softer, pelage, shorter tail and conspicuously smaller skull. It is possible that its relationships are with *rosilla* of Thomas, which is said to be a small, richly colored form, with a short tail.⁴ However, it is not identical with *rosilla* since it is even smaller in size and has the under parts white instead of ochraceous.

¹Type.

²Selected skull, the largest in the series.

³Only approximate since condyles are broken.

⁴1904, Ann. and Mag. Nat. Hist., (7) XIV, p. 35, July.

***Echimys longirostris*, new species**

TYPE.—No. 42886, Amer. Mus. Nat. Hist., sex indet.; Kartabo, British Guiana; July 26, 1920; collector Wm. Beebe. The type is an adult, teeth well worn, skin with skeleton.

GENERAL CHARACTERS.—Most like *armatus*, but differing in characters of pelage and in significant details of cranial structure, having much longer nasals and shallow postpalatal notch.

DESCRIPTION.—Pelage spiny, but with many unmodified hairs which partially mask the spines; hairs on crown only slightly spinous; color above, a mixture of black, ochraceous and buff, the ochraceous strongest on nose and face and posterior to shoulders along dorsal area; black strongest on neck and shoulders; flanks lighter than dorsal area and merging insensibly into the grayish under parts; hairs of underparts subspinous, gray at base and tipped with buff; pectoral area more brightly colored than posterior under parts; hands and feet grizzled gray, buff and ochraceous, dirty white distally; tail haired at base for about 50 mm., colored same as rump, scaly for rest of its length, sparsely haired, practically unicolor, ashy in color.

Skull elongate with convex superior outline; nasals long, slender, subcylindrical; lateral margins of temporals forming straight lines, not concave; postpalatal notch U-shaped, reaching scarcely beyond posterior margin of last molar; molar pattern typical of the genus.

MEASUREMENTS.—Taken from dried skin; total length, 466 m.; tail vertebrae, 225; hind foot, 38.

Reluctant as I have been to describe a new *Echimys* from a region already well supplied with names, I have been unable to reconcile the obvious characters of this specimen with those of *armatus* (= *guianæ* = *castaneus*). Aside from the differences in the character of the pelage (its apparently less spinous quality and the minor color differences), for which it might be remotely possible to account by consideration of the state of wear and the season, the cranial differences are too profound to be called individual variation. Eleven skulls of *Echimys* from the island of Trinidad, *castaneus* (= *guianæ* = *armatus*), of varying ages and a Demerara example of *armatus*, identified in the British Museum and received in an exchange from there, show complete accord with one another, in cranial characters with only very slight proportional variations. The skull of the new species is radically distinct from all of these skulls in the much longer nasals, the straight and not concave supra-orbital border, and the shallow postpalatal notch.

A careful search of the literature showing figures of *Echimys* skulls from northeastern South America has failed to disclose any examples with the characters above noted.

Only the one specimen of *longirostris* was collected.

MEASUREMENTS OF SKULLS OF *Echimyus longirostris* AND *E. armatus*.

	Greatest Length	Length of Nasals	Zygomatic Breadth	Least Inter-orbital Breadth	Breadth of Brain-case	Depth of Rostrum	Length of Palate	Alveolar Length of Upper Molar Series
<i>longirostris</i> 42886 type	56.5	19.3	26.3	14.2	21.3	11.4	23.7	11.7
<i>armatus</i> —Trinidad 4727	55.7	16.8	25.4	12.5	21	10.1	21.3	12.1
4728	55.8	15.9	25.8	13	21.3	10.6	21.8	11.9
4944	51.4	15.8	24.6	12	20.3	9.6	19.8	11.5
4946	53.1	15.9	24	11.9	19.8	10	20.3	11.3
6092	56	17.2	26.2	12.8	21.8	10.3	21.8	11.9
Demerara 36495	51.6	15	24.4	12.5	19.7	9.8	21	12.5

***Dinomys gigas*, new species**

1916. *Dinomys branickii* Allen, Bull. Amer. Mus. Nat. Hist., XXXV, p. 206, May 31, 1916.

TYPE.—No. 33913, Amer. Mus. Nat. Hist., La Candela, Huila, Colombia; altitude, 6,500 ft. The specimen is a flat hunter's skin, purchased by Mr. Leo E. Miller, of the Museum's expedition to Colombia, in 1912. It has no skull and there are no flesh measurements, while the skin lacks the tail and all four feet. Mr. Miller believed that the animal was killed near La Candela, where the hunter himself lived.

GENERAL CHARACTERS.—A very large species, heavily striped and with strongly contrasting pattern of black and white.

DESCRIPTION.—Color above, black, grizzled and striped with white; head a grizzled gray, neck to shoulders with less white; shoulders to base of tail with four heavy white stripes, continuous except at their extreme posterior end; flanks from fore to hind legs almost clear white, except that the dark bases of the white hairs show through to give a grizzled effect; legs and under parts similar to flanks; hair quite long everywhere.

MEASUREMENTS.—Length of flat skin, tip of nose to base of tail, 750 mm.

At the time that this specimen was identified by Dr. Allen, *loc. cit.*, as *branickii*, the Museum had no other specimens of *Dinomys*, and the identification was based upon the description by Peters.¹ Although the agreement was not very close, it was thought inadvisable to attempt description of a new form with such inadequate material. Now the Museum has two additional specimens of *Dinomys*, typical *branickii* from the Museu Goeldi at Para and *branickii occidentalis* from the Western Andes of Ecuador, while I have seen other specimens of *b. occidentalis* in the collection of Mr. Ludovic Soderstrom at Quito. Upon the basis of this material, it appears quite evident to me that the Colombian *Dinomys* can not be *branickii*, nor do I believe it to be a subspecies of it.

Aside from the difference in color between the Colombian skin and the specimen of *branickii*, which is dark brown, there is a marked difference in the color pattern. The specimen from Ecuador is more like the Candela skin in color but here too the difference in pattern exists. The new species has heavy continuous white stripes, averaging 10 mm. wide, of solid white hairs, while the stripes in both *branickii* and *occidentalis* are interrupted and more a series of semi-connected spots. The long hairs of the flanks form a much whiter covering than in the two known forms. The pelage of *gigas* is noticeably longer than that of the other specimens of *Dinomys* in the collection but whether this is seasonal, individual, or of specific character it would be difficult to say.

Although the flat skin may have been considerably stretched in preparation, it is so much larger than the skins of *branickii* and *occidentalis*, which measure a full fifty per cent less in total length, that the conclusion as to the greater size of *gigas* is unavoidable.

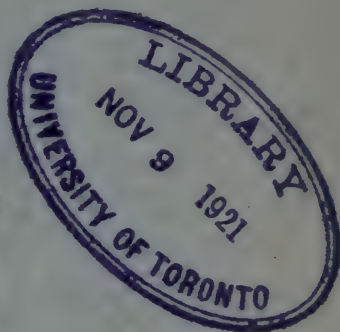
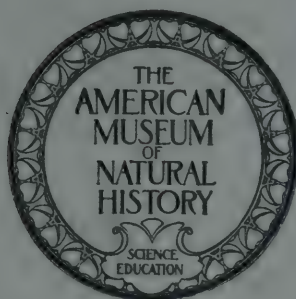
¹1873, Monatsb. k. p. Acad. Wissensch. Berlin, p. 552.

AMERICAN MUSEUM NOVITATES

No. 20

PRELIMINARY REPORT ON ECUADOREAN MAMMALS. No. 1.

By H. E. ANTHONY



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PRELIMINARY REPORT ON ECUADOREAN MAMMALS. NO. 1

BY H. E. ANTHONY

Field work done by The American Museum of Natural History in Ecuador in 1920 and 1921 has resulted in the acquisition of more than 900 mammals, to which was added, by purchase and as gifts from Mr. Ludovic Soderstrom of Quito, more than 600 mammals, making a collection which aggregates about 1550 specimens. Using this collection as a nucleus, it is planned to send out additional expeditions¹ and eventually to issue a report in full on the Mammals of Ecuador. From time to time preliminary reports will be published in order to place on record any forms new to science. The following is the first of these reports.

Ichthyomys tweedii, new species

TYPE.—No. 47798, Amer. Mus. Nat. Hist., ♂; Portovelo, Prov. del Oro, Ecuador; altitude, 2000 ft.; July 16, 1920; collector, H. E. Anthony. The type is a skin with skeleton.

GENERAL CHARACTERS.—A very large species, differing from the known forms of *Ichthyomys* in size and in cranial characters.

DESCRIPTION.—

Color above, a mixture of black, gray, and buff, the general impression being a grizzled brown; below, white, the plumbeous under-fur showing through to a slight extent; pelage throughout of two types of hair, the long, hard hairs and the soft, short under-fur; tail practically unicolor, slate black, rather densely haired.

Skull heavily built and strong, much larger than the skull of *soderstromi* or of *stolzmanni*; malar apparently absent; nasals tapering to a point posteriorly; rostrum very broad; a marked interorbital construction; zygomatic root of squamosal strongly developed; dentition essentially as in other species of *Ichthyomys*.

MEASUREMENTS.—Taken in the flesh: total length, 317 mm.; tail vertebræ, 150; hind foot, 36. See table on page 4 for measurements of skull.

Tweedii is so distinct from the other species of *Ichthyomys* that it may be advisable to erect for it a new subgenus. As only one specimen was taken, I have been loath to do this, since some of the characters may be, in part, individual. The Portovelo specimen is so much larger that it is not approached by the largest of a series of seven typical *soderstromi* from near Quito, while the size of the skull may be readily noted from the table of measurements.

¹A party whose members left New York in June and July, 1921, is now in Ecuador.

The wide rostrum, and rather flaring zygomatic arches, differentiate *tweedii* from either *soderstromi*, *stolzmanni* or *hydrobates*, while the areas for muscle attachment upon the frontals and parietals are so well marked as to indicate an animal of much greater strength. In the character of the heavy rostrum, *tweedii* is nearer to *stolzmanni* and *hydrobates* than it is to *soderstromi*, since the latter has the slenderest rostrum of the group.

The type specimen was brought in to me by a boy who caught it near his mother's house, near the banks of the Rio Amarillo. Although traps were set out for *Ichthyomys* in every suitable locality throughout the work in southern Ecuador, no additional specimens were secured. It is rather significant to note the low elevation at which this animal was taken, only 2000 feet above sea-level, as compared with the elevations at which the other species have been found, about 9000 feet in Peru and northern Ecuador, about 4000 feet in Merida, Venezuela.

I take pleasure in naming this fine species in honor of Mr. A. M. Tweedy, the resident manager of the mine at Portovelo, who extended to the Museum's expedition all the assistance it lay in his power to give.

NEUSTICOMYS, new genus

GENOTYPE.—*Neusticomys monticolus*, new species.

GENERAL CHARACTERS.—Allied to *Ichthyomys*, *Rheomys*, and *Anatomys*, from each of which it differs in the greatly reduced hallux and in the character of the dentition.

DESCRIPTION.—Size small, fur very soft and close, with scattering of longer, outer hairs; hind foot least specialized of the group for aquatic life, hallux not extending beyond tubercle at base of adjacent digit; skull smooth and typically cricetine, without upturned nasals, incisors showing little specialization; infraorbital foramen large; supraorbital foramina laterally placed; palatal foramina very long, extending from molar toothrow almost to incisors; molars essentially as in *Ichthyomys* but last lower molar with single cusp instead of two.

Neusticomys monticolus, new species

TYPE.—No. 46574, Amer. Mus. Nat. Hist., ♀ ad.; Nono Farm, "San Francisco," near Quito, Ecuador; February 16, 1916; collector, Ludovic Soderstrom. The type is a skin, in excellent condition, and a skull.

GENERAL CHARACTERS.—Superficially most like *Rheomys* in color, character of fur, and size, but with greatly reduced hallux; noticeable external ear, naked median line from nostrils to upper lip, and very soft fur.

DESCRIPTION.—

Color above, uniform clove-brown (Ridgway), the hairs blackish plumbeous at the base; below, lighter with irregular washing of pale smoke-gray along the median area and a small ivory-yellow pectoral spot; feet soiled whitish; tail above and below like back but with a faint sprinkling of whitish hairs, especially along under surface.

Skull compressed, with broad flat braincase, smooth, without ridges on frontals or parietals, a scarcely perceptible depression at base of nasals, but plane of nasals continuous with that of frontal area; rostrum slender; zygomatic arch threadlike or incomplete; infraorbital foramina very large; palatal foramina very large and filling almost entire space between first molars and incisors, broadest medially; conspicuous peglike process on maxillary roots of zygomata just external to molar series; incisors of piercing type but not highly specialized as in *Ichthyomys*; upper molars not differing appreciably from those of *Ichthyomys*; coronoid process long, slender, falciform; lower molars somewhat different in pattern from those of *Ichthyomys* and *Rheomys*, anterior cusp of first molar broader, last molar with only one functional cusp, the posterior cusp being vestigial.

MEASUREMENTS.—Taken from the dried skin; total length, 204 mm.; tail vertebrae, 111; hind foot, 25.

This most interesting specimen is one of a collection of mammals obtained from Mr. Ludovic Soderstrom, who commented especially upon it when he gave it to me, expressing the opinion that it was not *Ichthyomys soderstromi*. This was quite evident when the specimen was compared with a good series of *Ichthyomys*, fourteen specimens representing four species, and *Rheomys*, one specimen. That it should prove to be an unknown genus is rather surprising, but, since it cannot be definitely referred to one of the existing genera, I find it necessary to erect a fourth genus of the *Ichthyomys* group.

From any of the species of *Ichthyomys*, *Neusticomys monticolus* may be readily distinguished by its much smaller size and less advanced specialization for swimming. The feet and toes of this new form are only weakly fringed with hairs, while the foot of *Ichthyomys* is a most obvious swimming structure. From *Rheomys*, which genus has not been taken south of Panama, to my knowledge, *Neusticomys* can be told by its greatly reduced hallux and by its single cusped last lower molar. *Anatomys leander*, described from the Quito region by Thomas,¹ is much larger, lacks the external ear, which in *Neusticomys* is proportionally larger than in *Ichthyomys* and actually as large, has "muzzle set on in a peculiar manner," while the superior outline of the skull of *Neusticomys* is almost a straight line. A second specimen of *Anatomys* recorded by Lönnberg² who confirms the type description, proves that the peculiarities of the type specimen are not fortuitous or individual. Although I have not seen *Anatomys*, I feel *Neusticomys* can have so little in common with this genus, that I have not hesitated to describe it as a new.

Apparently, *Neusticomys* is the least specialized of the *Ichthyomys* group.

¹1906, Ann. and Mag. Nat. Hist., (7) XVII, p. 86, January.

²1921, Archiv. för Zool., XIV, No. 4, p. 37.

MEASUREMENTS OF SKULLS OF DIFFERENT MEMBERS OF THE *Ichthyomys* GROUP

	GREATEST LENGTH	LENGTH OF NASALS	ZYGOMATIC BREADTH	BREADTH OF BRAINCASE	BREADTH OF ROSTRUM, AT MAXILLARY SUTURES	INTERORBITAL BREADTH	PALATAL FORAMINA	ALVEOLAR LENGTH OF UPPER MOLAR SERIES	DIASTEMA	LENGTH, PALATE TO INCISORS	GREATEST LENGTH OF MANDIBLE	LENGTH OF MANDIBULAR MOLAR SERIES
<i>Neusticomys monticolus</i> 46574 type	26	9.4	12.4	12.5	4.4	4.8	4.7×2.3	4.3	6	10.8	15.8	4.4
<i>Rheomys raptor</i> ¹ 179026	25.2	10.3	13.2	12.2	4.3	4.8	4.6×1.9	4.2	6.2	11.3	16	4.1
<i>Anatomys leander</i> ² <i>Ichthyomys tweedii</i>	27.5	9	14.8	13.8		3.9	4.9×2.3	4.6	6.7	11.2		
47798 type	35.3	12.5	18.8	15	7.5	4.3	6.4×2	5	9.3	16	25	4.5
<i>Ichthyomys soderstromi</i> 46730	31	11.5	15.5	14	6	4.8	5.8×1.9	4.5	8.3	14	21.5	4.5
46732	31.7	11.6	16.1	13.5	5.5	4.9	6×1.9	4.2	8.7	13.8	21.5	4.5
<i>Ichthyomys stolzmanni</i> 10109	32	9.3	15.7	13.9	6	4.7	6.1×2.3	3.9	8.3	14.4	21	4
<i>Ichthyomys hydroabates</i> 24354	32.8	10.5	15.5	14	6	4.4	6.6×2	4.5	8.5	15	22	4

¹Kindly loaned by U. S. N. M., Biol. Surv. Mammal Coll.

²Measurements taken from Thomas, *loc. cit.*

Blarina montivaga, new species

TYPE.—No. 47200, Amer. Mus. Nat. Hist., ♀ ad.; Bestion, Prov. del Azuay, Ecuador; altitude 10,000 ft.; January 15, 1921; collector, H. E. Anthony. The type is a skin with skeleton, the teeth not showing any great amount of wear.

GENERAL CHARACTERS.—Resembling *equatoris* of Thomas,¹ but differing conspicuously in color.

DESCRIPTION.—

Color above, everywhere approximating a dark mouse-gray (Ridgway); below, mouse-gray; no area of demarcation along sides where color of upper parts merges into that of lower parts; tail agreeing in color with body.

Skull slightly larger than that of *equatoris*, with third unicuspid noticeably larger; dentition very lightly pigmented.

MEASUREMENTS.—Taken in the flesh: total length, 112 mm.; tail vertebræ, 31; hind foot, 15. Skull, greatest length, 22 mm. (20)²; mastoid breadth, 10.5 (9.7); length entire upper toothrow, 9.7 (8.7).

Montivaga may be easily distinguished from all other known *Blarina* from South America on the basis of color alone, being much grayer than the dark brown or blackish pelages, of *squamipes*, *meridensis*, *thomasi*, *equatoris*, or *osgoodi*.³ A series of five, all collected at the type locality, are very uniform in coloration.

The new species has a hairy foot, showing very little of the squamation which characterises *squamipes*, and, to a certain extent, *equatoris*. The teeth of *montivaga* are almost entirely white, displaying but slight pigmentation, a character which appears to be fairly conspicuous in *squamipes*, *thomasi*, *equatoris*, and *osgoodi*.

Anoura geoffroyi antricola, new subspecies

TYPE.—No. 47282, Amer. Mus. Nat. Hist., ♀ ad.; Loja, Ecuador; altitude 9000 ft.; October 30, 1920; collector, H. E. Anthony. The type is a skin with skull.

GENERAL CHARACTERS.—Similar to *geoffroyi geoffroyi* in size but noticeably darker in coloration, less brown.

DESCRIPTION.—Above, hairs clove-brown (Ridgway), lighter colored at the base, except on rump where hairs are almost unicolor, the lightest colored basal area being on the shoulders where the color is pale olive-buff; below, hair brown, darker at the base on abdominal region, unicolor on throat; membranes blackish.

MEASUREMENTS.—Taken in the flesh: total length, 81 mm.; hind foot, 13.5. Greatest length of skull, 26 (*geoffroyi*, 24.5; *apolinari*, 25.5); breadth of braincase, 10 (10; 9.5); least breadth of rostrum, 4 (4.5; 4); length of palate, to gnathion, 14.5 (13.5; 14); length of upper molar series, 8.5 (7.5; 8.25).

¹1912, Ann. Mag. Nat. Hist., (8) IX, p. 409.

²Measurements in parentheses are of No. 46683, *Blarina equatoris*, from the slopes of Pichincha.

³Dr. Witmer Stone, of the Academy of Natural Sciences of Philadelphia, has kindly loaned me specimens of *osgoodi*, which I rather suspect must stand as a synonym of *equatoris*, described in 1912 by Thomas, who had specimens from the same slopes whence came the type of *osgoodi*. More material is needed to settle this point.

A large series of this form were taken, both as skins and as specimens in alcohol, and twenty-four skins afford an excellent opportunity to note the extent of individual variation. The entire series agrees with the type in dark coloration and no one of them approaches specimens of typical *geoffroyi* from Trinidad and Merida. In coloration the Ecuador series more nearly resembles *Anoura geoffroyi apolinari* (Allen), which was described as a *Glossophaga*¹ but which upon an examination of the skull I find to be an *Anoura* subspecifically distinct from *geoffroyi*. However, they lack the warmer shade of brown seen in *apolinari*.

***Cænolestes caniventer*, new species.**

TYPE.—No. 47174, Amer. Mus. Nat. Hist., ♂ ad.; El Chiral, Western Andes; altitude, 5350 ft.; Prov. del Oro, Ecuador; August 2, 1920; collector, H. E. Anthony. The type is a skin and skeleton.

GENERAL CHARACTERS.—Resembling *fuliginosus* but less brownish above and decidedly lighter colored below; larger in size.

DESCRIPTION.—

Color, above, fuscus black (Ridgway) in effect, the pelage made up of dark hairs and a sprinkling of buffy tipped hairs, the color of all the hairs plumbeous at the base; below, much lighter than above, the tips of the hairs varying from cream-color to soiled whitish with a darker pectoral area approaching in color the hairs of the upper parts; hands and feet light brown; tail but little lighter below than above, brown.

Skull essentially like that of *obscurus* or *fuliginosus* but apparently larger.

MEASUREMENTS.—Taken in the flesh; total length, 256; tail vertebrae, 127; hind foot, 26.5. Greatest length of skull, 33.5; length of nasals, 16; zygomatic breadth, 16.3; mastoid breadth, 11.5; length of upper toothrow, I-M⁴, 17.6

Through the kindness of Dr. Stone, I have before me the two specimens of *Cænolestes fuliginosus* collected by Rhoads on Mt. Pichincha, both females, the trunks of which are preserved in alcohol. I have had the skull of one of these carcasses cleaned for examination. I also have for comparison a skin, without skull, from Papallacta, Ecuador, donated by Mr. Soderstrom of Quito, which I have determined to be *fuliginosus*; and, finally, a specimen of *obscurus*, male, skin and skull, from the Plains of Bogotá. I have sufficient material to be certain that the southern Ecuador *Cænolestes* is a distinct species, the most obvious character of separation being that of color, but in addition the new species is apparently larger. Because there is considerable difference in size shown by the series of *caniventer*, coupled with the fact that the males are noticeably larger than the females, it is not safe at present to be positive that the apparent size difference is the true one.

However, *caniventer* differs more radically in color from either *obscurus* or *fuliginosus* than do the latter from one another.

¹1916, J. A. Allen, Bull. Amer. Mus. Nat. Hist., XXXV, p. 86.

AMERICAN MUSEUM NOVITATES

No. 21

SOME PARASITIC MEGACHILID BEES OF THE WESTERN UNITED STATES

By T. D. A. COCKERELL



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SOME PARASITIC MEGACHILID BEES OF THE WESTERN UNITED STATES

BY T. D. A. COCKERELL

The fauna of the Western United States, especially that of the Rocky Mountain and Pacific Coast Regions, when fully known, will doubtless furnish many valuable clues to aid in solving the perplexing problems of geographic distribution in North America. As still further collecting is desirable before the final report of the American Museum's expeditions is published, the following notes on the parasitic megachilid bees thus far obtained are presented at this time. The specimens were collected by Dr. Frank E. Lutz, except where otherwise noted, and the field notes are by him.

Cœlixys Latreille

Cœlixys deplanata Cresson

UTAH: 1 ♀, Huntsville (a few miles east of Ogden), July 26, 1920; 3 ♀, near Fort Douglas, Salt Lake City, about 5000 ft. alt., July 28, 1920. COLORADO: 1 ♂, hair of face pure white, Palisades, near Grand Junction, about 4750 ft. alt., at *Melilotus alba*, July 18, 1919; 1 ♀, Wray, about 3700 ft. alt., August 17, 1919; 1 ♂, large, hair of face creamy white, lower apical spines of abdomen very stout; Regnier, south of Lamar, about 4400 ft. alt., June 8, 1919. All of these specimens were found in quite xerophytic situations.

Cœlixys novomexicana (Cockerell)

ARIZONA: 1 ♀, Lowell Ranger Station, about 2700 ft. alt., August 18, 1916; 2 ♂, Sabino Basin, about 3800 ft. alt., July 10, 1916; 1 ♂, Mud Springs, about 6500 ft. alt. All of these localities are in the Santa Catalina Mts. along the Sabino trail from Tucson to Mt. Lemon. Mud Springs is rather high in the oak-pinyon environment; the Sabino Basin presents a variety of conditions within a small area but chiefly xerophytic; the country at Lowell is desert—the lower part of the Upper Bajada (Shreve's nomenclature)—but the Sabino River and a water hole introduces more mesophytic vegetation.

The male is new. It runs in my table (1912, Canadian Ent., XLIV, p. 168) of males to *sayi*, from which it is known by the two spots of pubescence on the anterior part of the mesothorax and by the entirely red femora. The Sabino Basin specimens differ in having the first recurrent nervure received at the extreme base of second submarginal cell, almost meeting the transverse cubital. They are also a little smaller.

***Cœlioxys octodentata* Say**

(= *altilis* Cresson)

UTAH: 1 ♀, Ogden, about 4350 ft. alt., August 30, 1916. COLORADO: 2 ♀, Wray, about 3700 ft. alt., along Dry Willow Creek, August 18, 1919. INDIANA: 1 ♀, Lafayette, August 16, 1920. Even the western specimens came from moderately mesophytic situations along streams.

***Cœlioxys modesta* Smith**

INDIANA: 1 ♀, Lafayette, August 16, 1920. A variety with dark legs and nervures.

***Cœlioxys apacheorum* Cockerell**

COLORADO: 1 ♀, between Boulder and Orodell along the rather mesophytic canyon bottom, about 5600 ft. alt., August 11, 1919.

Described from New Mexico.

***Cœlioxys rufitarsis* Smith**

UTAH: 1 ♀, 3 rather small ♂, Ogden, about 4350 ft. alt., August 30, 1916; 1 ♂, Huntsville (a few miles east of Ogden), July 26, 1920; 1 ♀, Provo, about 4500 ft. alt., in an irrigated field, July 31, 1920. COLORADO: 1 ♀, Palisades, near Grand Junction, about 4750 ft. alt., July 18, 1919; 1 ♀, 1 ♂, Rifle, about 5400 ft. alt., July 19, 1919; 1 ♀, from a vacant lot in Pueblo, August 9, 1920.

***Cœlioxys ribis* Cockerell**

WYOMING: 1 ♀, Jackson, about 6300 ft. alt., among aspens and various plants of a moderately moist pasture-land type, July 15, 1920. COLORADO: 1 ♂, Ouray, about 8500 ft. alt., among Douglas spruce, aspen, scrub-oak, etc., July 11, 1919; 1 ♀, August 7, 1920, and 1 ♂, August 1, 1919, Tennessee Pass, about 10,400 ft. alt., in the lodge-pole pine area; 1 ♀, 1 ♂, Leadville, about 10,200 ft. alt., collected in the town by Mr. H. F. Schwarz.

***Cœlioxys porterae* Cockerell**

COLORADO: 1 ♀, between Aspen and Highland along Castle Creek, about 8500 ft. alt., oaks, aspens and a few spruce, collected by Mr. H. F. Schwarz, July 25, 1919; 1 ♀, Glenwood Springs, about 5800 ft. alt., oak, squaw-bush, sunflower, etc., collected by Mrs. F. E. Lutz, August 5, 1920, 1 ♀, Boulder, about 5500 ft. alt., in town, August 8, 1919.

This was described as a possible variety of *lucrosa* Cresson but the transverse channel on the second abdominal segment is deep and entire, whereas, according to Sladen, it is widely interrupted in *lucrosa*. The type locality of *lucrosa* is New York State.

***Cœlioxys texana* Cresson**

INDIANA: 1 ♂, Lafayette, August 16, 1920.

***Cœlioxys edita* Cresson**

COLORADO: 1 ♂, Meeker, about 6200 ft. alt., at *Grindelia serrulata*, July 21, 1919.

Crawford has suggested that this is a synonym of *deplanata*. I am able to recognize some differences, and for the present must regard *edita* as valid.

***Cœlioxys sayi* Robertson**

INDIANA: 1 ♂, Lafayette, August 16, 1920.

The form from Virginia which I had regarded as *sayi* has longer axillar spines, the abdomen with larger and sparser punctures, and the last dorsal segment more produced. It is certainly distinct. Robertson's name *sayi* must be considered as based on Say's *octodentata* variety α . "Spots and lines of the thorax [i. e., of white pubescence] obsolete; feet, excepting the tarsi, black." The Virginia insect has the spots and lines present, but the clypeus is bilobed. The last dorsal segment is more produced than in *octodentata*. The femora are black with red knees, tibiæ red stained with black, tarsi reddish basally, apically black, the hind pair black from end of basitarsi on. This may accordingly be separated as:

***Cœlioxys mendacina*, new species**

TYPE: ♀. Falls Church, Virginia, June 2, (N. Banks). Length a little over 9 mm. The male (length, 8.2–9 mm.) is indicated in the table below.

It is quite likely that Say mixed more than one species, even under his variety α ; but Cresson's description of *octodentata* (1864) which Robertson cites under *sayi*, disagrees in saying that the legs are ferruginous, "the coxæ and sometimes the femora and tibiæ more or less blackish." The Lafayette *sayi* agrees with Crawford's statement that the clypeus is bilobed as viewed from above, not truly emarginate. It seems reasonable to take the Indiana form as true *sayi*, but the whole matter is perplexing. The male of *sayi*, according to Robertson, has the legs black, the tibiæ and tarsi more or less tinged with red.

***Cœlioxys fragariæ* Cockerell**

COLORADO: 1 ♂, Meeker, about 6200 ft. alt., along the river bank, July 21, 1919.

I give a new description from the Colorado specimen, as the original account was rather brief.

♂.—Length, about 11 mm., slender; black, including tarsi, mandibles and antennæ, but tegulæ red; face densely covered with pure white hair, but on cheeks it is thinner, not wholly hiding surface, but with no smooth space; eyes grayish, with moderately long hair; third antennal joint shorter than fourth; mesothorax and

scutellum densely and very closely punctured, the mesothorax with a median longitudinal depression; anterior margin of mesothorax with a pair of conspicuous white hair-spots; bands of white hair behind mesothorax and scutellum; scutellum with very large punctures, no apical projection; axillary teeth long and somewhat curved; wings dusky hyaline, broadly infuscated apically; stigma ferruginous, nervures fuscous; basal nervure falling a little short of transverse median; recurrent nervures joining second submarginal near apex and base; spurs red; abdomen shining, with strong sparse punctures; first segment with basal and apical white bands, band on basal segment interrupted in middle, the others with successively weaker white bands, but strong bands of white hair in the transverse sulci, broadly interrupted on second, successively less interrupted on the following segments, and nearly entire on the fifth; sides of second segment behind sulci with large opaque areas but no foveæ; fifth segment without distinct lateral spines, sixth with slender lateral spines and six apical ones, the upper apical being each divided into two sharp spines; fourth ventral segment with two sharp spines on margin.

By the two spines on the fourth ventral this falls next to *C. erysimi* Cockerell, which is very closely related. *C. erysimi* has black tegulæ. *C. quercina* Cockerell is of the same group, but the legs are largely bright ferruginous. For other distinctions see Canadian Entomologist, June 1912.

***Cœlixys aperta* Cresson**

COLORADO: 1 ♂, Meeker, about 6200 ft. alt., at *Grindelia serrulata*, July 21, 1919.

C. aperta was based on a single female collected by Morrison in Colorado. The male before me may I think be safely referred to the same species.

♂.—Length 10 mm.; black, including antennæ, mandibles and tarsi, the tegulæ very obscurely reddish in middle; face, front and cheeks densely covered with long pure white hair; cheeks beneath with a small inconspicuous bare area; third antennal joint longer than fourth; eyes pale green, with moderately long hair; mesothorax and scutellum coarsely and densely punctured, scutellum with a median projection; axillary spines very long, sharp, wings brownish, stigma and nervures dark; basal nervure meeting transverse median; first recurrent nervure joining second submarginal cell nearer base than second to apex; anterior coxæ spined; abdomen with very broad pure white hair-bands on segments 1 to 5; no white hair at bases of segments or in sulci; second segment strongly punctured, without foveæ; sides of fifth with short spines; sixth segment short, with long curved lateral spines and four short apical ones, the upper very broad; venter with broad, dense, white hair-bands.

On account of the median projection on scutellum, this falls next to *C. germana* Cresson and *C. totonaca* Cresson. For the distinctions see Psyche, October 1905, p. 89.

***Cœlixys lucrosa* Cresson**

COLORADO: 2 ♂, Telluride, along the trail near Cornet Creek at about 10,000 ft. alt., chiefly aspen following cut-over spruce; July 9, 1919; 1 ♂, Boulder, about 5500 ft. alt., at *Grindelia* in town, August 8, 1919.

Cresson described *C. lucrosa* from the female, collected by Comstock in New York State, and by Morrison in Colorado. I have never found the female in Colorado. Sladen (Canadian Entom., June 1915) gave characters for both sexes. The males recorded above agree with his account of male *lucrosa*, and are referred there. I give a description from a Telluride specimen.

♂.—Length about 9 mm.; black, including tarsi, mandibles, antennæ and tegulæ; face with long white hair, faintly tinged with creamy; cheeks with thin hair, and a large smooth space below; third antennal joint longer than fourth; eyes gray, with moderately long hair; mesothorax and scutellum strongly punctured, but disc of mesothorax shining between punctures; scutellum simple; axillary teeth short, triangular, wings hyaline, broadly dusky apically; stigma ferruginous, nervures fuscous; basal nervure falling short of transverse median, second submarginal cell receiving recurrent nervures about equally distant from base and apex respectively; spurs red; abdomen shining, sparsely punctured, with pure white hair-bands on apices of segments 1 to 4, broad at sides but very thin in middle; sulci without hair, interrupted in middle; foveæ on second segment large and elongate; fifth segment with short stout lateral spines; sixth with long sharp ones; apex of sixth with four spines, the lower ones long and slender; margin of fourth ventral segment in middle smooth and reddish.

Cœlioxys lutzi,¹ new species

UTAH: 1 ♀ (the type), Ogden, about 4400 ft. alt., in the Ogden canyon near "Pine View," mesophytic situation along the stream, August 29, 1916. WYOMING: 1 ♂, Jackson, about 6300 ft. alt., aspens and various plants of a moderately moist pasture-land type, July 15, 1920. COLORADO: 1 ♂, at about 37° 27' N., 106° 54' W. in Mineral county near Wolfand Fall Creeks along the road across the continental divide, oak, Engelman spruce, etc., June 20, 1919.

♀.—Length, 10.5 mm.; black, including tarsi, tegulæ, antennæ and mandibles; head and thorax with dull white hair, abundant on thorax behind; clypeus normal, minutely and densely punctured, with some large punctures interspersed; eyes gray, with short hair; third antennal joint nearly as long as fourth; mesothorax and scutellum very densely and coarsely punctured; scutellum simple; axillary spines short, thornlike, curved; wings dusky hyaline, stigma and nervures dark; first recurrent nervure joining second submarginal farther from base than second from apex; basal nervure meeting transverse median; second submarginal cell very broad on marginal cell; spurs black; abdomen shining, sparsely punctured; white hair-bands on apices of segments 1 to 4, broadly interrupted on first; no white hair in sulci; sulcus on second segment entire, the region behind it in middle very sparsely punctured; last dorsal sharply pointed, keeled its whole length, not abruptly narrowed at sides; last ventral considerably longer than last dorsal, narrow, minutely notched on each side before apex; third ventral segment strongly punctured, but with a median oval smooth space in which is a small tubercle; last ventral closely punctured.

¹Named after Dr. Frank E. Lutz, the leader of the Rocky Mountain Expeditions, which will enormously increase our knowledge of western entomology when the rich materials have been sorted and recorded.

♂.—Length about 9 mm.; face with long white hair; third antennal joint quite as long as fourth; large irregular punctures in middle of mesothorax, with a little shining surface showing between; cheeks with a smooth space below; anterior coxæ spined; abdomen shining, sparsely punctured, with entire pure white bands on apical margins of segments and white hair at base of fifth and sixth, second segment with small foveæ; sides of fifth with very short spines, of sixth with long ones; apex of sixth quadridentate, all the teeth rather slender, the upper ones divergent, the lower forming a U; fifth ventral segment depressed and shining in middle.

The female runs to *C. mæsta* Cresson in Crawford's table, but it differs in the color of the tegulæ and the shining area on under side of abdomen. The male is known from *mæsta* by the character of the foveæ on second abdominal segment.

***Cœlixys mesæ*, new species**

COLORADO: 1 ♂, on the Chapin mesa at about 37° 12' N., 108° 29' W. in the Mesa Verde National Park, pinyon, Sabina, sagebrush, etc., at the flowers of *Pentstemon coloradensis*, July 5, 1919.

♂.—Length about 10 mm., robust; black, including legs, mandibles and antennæ; tegulæ dark reddish, head broad, face with long white hair, cheeks little hairy, densely and coarsely punctured, with a smooth space on extreme lower part; third antennal joint slightly longer than fourth; eyes pale green, with moderately long hair; mesothorax and scutellum densely, coarsely punctured; margin of scutellum simple; axillary spines rather long; wings brownish hyaline, stigma clear ferruginous, nervures fuscous; basal nervure meeting transverse median; second submarginal cell receiving first recurrent nervure nearer base than second recurrent nervure from apex; anterior coxæ with very stout spines; spurs dark red; abdomen closely punctured, the second and third segments dull and densely punctured, with strong entire transverse sulci, which are not hairy; hind margins of segments 1 to 4 with white hair-bands, and white hair also at bases of 4 and 5; first segment also with a broad basal hair-band, so that not much of its upper surface is exposed; fifth segment with short stout lateral teeth, sixth with long but obtuse ones; apex of sixth with four teeth, the upper two more divergent than the lower; lower rather short; venter closely punctured, segments 2 to 4 with broad white hair-bands.

Especially known by the sculpture of the abdomen.

***Cœlixys lamellicauda*, new species**

COLORADO: 1 ♂, Meeker, about 6200 ft. alt., collected in the school grounds by Mr. Pearce Baily, Jr., July 21, 1919.

♂.—Length about 9 mm.; black, including mandibles, tarsi, antennæ and tegulæ; face and cheeks with dense pure white hair, cheeks with groove below; third antennal joint longer than fourth; eyes gray, with short hair; mesothorax and scutellum densely punctured; scutellum simple; axillary spines long; wings hyaline, dusky apically, stigma dark reddish, nervures fuscous; basal nervure meeting transverse median, second submarginal cell receiving first recurrent nervure nearer base than second recurrent nervure from apex; anterior coxæ with very stout spines; spurs red; hind margins of abdominal segments with broad entire hair-bands; first

segment also with a basal band; no hair in the sulci, which are entire on segments 2 and 3; segment 2 with small shining spaces but no foveæ; sides of fifth segment with very short teeth, of sixth with long ones; apex of sixth with four teeth, the upper ones very broad and obtuse, strongly divergent; venter with entire white hair-bands.

Especially known by the shining areas (but no foveæ) on second abdominal segment, and lamelliform upper apical teeth.

The above *Calioxys* may be separated by the following key.

1. Females.....2.
Males.....12.
2. Legs red; eyes with short hair.....3.
Legs mainly or wholly black, or only tarsi red.....5.
3. Last ventral segment very broad; margin of clypeus entire...*deplanata* Cresson.
Last ventral segment rather narrow.....4.
4. Over 12 mm. long; clypeus deeply notched or bilobed...*novomexicana* Cockerell.
Under 10 mm. long; clypeus ordinary.....*octodentata* Say.
5. Last ventral broad, entire, without lateral notches.....6.
Last ventral notched at sides.....7.
6. Axillary spines short; last ventral very broad, with an apical point.
modesta Smith.
- Axillary spines long; last ventral without a salient apical point.
apacheorum Cockerell.
7. Last dorsal with salient lateral angles, or abruptly notched...*rufitarsis* Smith.
Last dorsal without such angles.....8.
8. Last ventral broad, with strongly convex margins before the long apical projection (see figure in Canadian Entom., July 1915, p. 205); hair on eyes long.....*ribis* Cockerell.
Last ventral without strongly convex sides.....9.
9. Conspicuous white hair-markings on thorax above; clypeus bilobed or broadly emarginate, with dense pure white hair filling space between clypeus and mandibles; angle formed by emargination of clypeus less acute than in *novomexicana*.....*mendacina* Cockerell.
No conspicuous white hair-markings on thorax above.....10.
10. Last ventral very narrow; third ventral with a median polished oval impunctate space.....*lutzi* Cockerell.
Last ventral not so narrow; third ventral without a specialized area.....11.
11. Tegulae clear bright ferruginous; hair of eyes very short.....*sayi* Robertson.
Tegulae dark rufopiceous; hair of eyes much longer.....*porteræ* Cockerell.
12. Legs at least mainly red.....13.
Legs red, coxæ and under side of femora black; second abdominal segment with small foveæ; hair of eyes short; hair of face pure shining white; cheeks with a large bevelled hairless space; apex of sixth abdominal segment quadridentate, the upper teeth strongly diverging...*mendacina* Cockerell.
Legs mainly or wholly black.....16.
13. Mesothorax with large well-separated punctures on disc; tegulae bright ferruginous; end of abdomen multidentate.....*texana* Cresson.

- Mesothorax very densely punctured; conspicuous light hair in scutello-mesothoracic suture.....14.
14. Second abdominal segment with a pair of small oval foveæ on a smooth surface.
novomexicana Cockerell.
Second abdominal segment without such foveæ.....15.
15. Larger; abdomen more coarsely and less densely punctured; first recurrent nervure joining second submarginal cell as far from base as second from apex.....*deplanata* Cresson.
Smaller; abdomen more finely and closely punctured; first recurrent nervure joining second submarginal cell very near base, or even meeting first transverse cubital.....*edita* Cresson.
16. Scutellum with a median apical tubercle; lower apical teeth of abdomen divergent; tegulæ almost pure black; hair of eyes long....*aperta* Cresson.
Scutellum without a median tubercle.....17.
17. Conspicuous light hair in scutello-mesothoracic suture; apex of sixth abdominal segment with six teeth; fourth ventral with two sharp spines on margin.
fragariæ Cockerell.
No conspicuous sutural hair or spots on thorax above; tegulæ black or dark reddish.....18.
18. Tarsi red.....*rufitarsis* Smith.
Tarsi black, lower apical teeth of sixth segment parallel or almost.....19.
19. Stigma ferruginous; first recurrent nervure going only a little beyond first transverse cubital; second abdominal segment dull and very densely punctured.....*mesæ* Cockerell.
First recurrent nervure going considerably beyond first transverse cubital; stigma often piceous.....20.
20. Rather large and robust; second abdominal segment behind the sulcus very densely and finely punctured, without foveæ; hair of eyes very long.
ribis Cockerell.
Smaller or more slender; second abdominal segment otherwise.....21.
21. Second abdominal segment with large transverse foveæ; axillary spines very short; apex of fourth ventral abdominal segment produced, smooth, bare and red; transverse sulcus on second abdominal segment interrupted; second submarginal cell on marginal hardly or not longer than first transverse cubital.....*lucrosa* Cresson.
Second abdominal segment with foveæ minute or absent.....22.
22. Axillary spines long; second segment with a pair of shining spaces but no foveæ.....*lamellicauda* Cockerell.
Axillary spines very short; second segment with small elongate-punctiform foveæ; second submarginal cell on marginal considerably longer than first transverse cubital; transverse sulcus on second abdominal segment entire.
luzti Cockerell.

The host-relationships of the American *Cælixys* are little known. Grænicer found *C. rufitarsis* Smith parasitic on *Megachile melanophæa* Smith and *M. latimanus* Say. He found *C. lucrosa* Cresson or a closely related species parasitic on *M. addenda* Cresson. In Europe there are records of *Cælixys* parasitic on *Anthophora*, but they need confirmation.

According to the statements of Alfken (Die Bienenfauna von Bremen), the species of *Cælixys* do in some cases live on more than one species of *Megachile*, but they are by no means indiscriminate. Thus we have:

Parasite	Host
<i>C. aurolimbatus</i> Först	<i>Megachile ericetorum</i> Lepeletier
<i>C. trigonus</i> Schrank	<i>M. maritima</i> Kirby
<i>C. quadridentatus</i> Linnæus	<i>M. circumcincta</i> Kirby and <i>M. willughbiella</i> Kirby
<i>C. acuminatus</i> Nylander	<i>M. centuncularis</i> Linnæus (probably)
<i>C. mandibularis</i> Nylander	<i>M. argentata</i> Fabricius
<i>C. rufocaudatus</i> Smith	<i>M. rotundata</i> Fabricius

Bingham, in India, observed that *C. basalis* Smith lived in nests of *M. lanata* Fabricius. As *Cælixys* is world-wide, one might expect to find the number of species roughly proportioned to that of *Megachile*. In Australia, however, the forms of *Megachile* are excessively numerous and varied, but there are only four *Cælixys* (*albiceps* Friese, *reginæ* Cockerell, *albolineata* Cockerell, *froggatti* Cockerell). It seems probable that the genus originated in the Western Hemisphere; it is especially abundant in the Neotropical Region, with 110 species described up to the present time.

In the Nearctic Region, the species seem to be usually restricted, or nearly restricted, to a single province, as we find with other bees. *C. lucrosa* Cresson and *sodalis* Cresson are reported from New York to Colorado; *C. rufitarsis* Smith is similarly widely distributed in the Northern part of the continent and the western mountains. *C. octodentata* Say, *mæsta* Cresson and *porteræ* Cockerell also extend from the Atlantic coast region to the Rocky Mountains. Presumably these all infest the wide-spread species of *Megachile*, whereas the more local ones parasitise the local species of the host-genus. *C. fragariæ* Cockerell was described from an altitude of 6000 ft. on the San Jacinto Mountains of California; it now turns up at about the same altitude in Western Colorado.

The Nearctic *Cælixys* at the present time number 52 species and six races or varieties. Of these, nine (*edita* Cresson, *insita* Cresson, *scitula* Cresson, *texana* Cresson, *hunteri* Crawford, *piercei* Crawford, *arenicola* Crawford, *asteris* Crawford, *pratti* Crawford), were described from Texas, whence *edita* and *texana* extend northward. A race of *texana* (*sonorensis* Cockerell) occurs at San José de Guaymas, Mexico. Ten (*menthæ* Cockerell, *gilensis* Cockerell, *porteræ* Cockerell, *apacheorum* Cockerell, *grindeliæ* Cockerell, *ribis* Cockerell, *soledadensis* Cockerell, *texana vegana* Cockerell, *rufitarsis rhois* Cockerell, *novomexicana* Cockerell) were

described from New Mexico. Of these *porteræ* extends to Virginia, and *ribis* has been taken by Grænicher in Wisconsin and by Sladen in Ontario. *C. apacheorum* is now recorded from Colorado.

Six (*coquilletti* Crawford, *angelica* Cockerell, *fragariæ* Cockerell, *hirsutissima* Cockerell, *megatricha* Cockerell, *angulifera* Cockerell) have been described from California. Of these, *fragariæ* extends eastward to Colorado. Four (*floridana* Cresson, *slossoni* Viereck, *obtusiventris* Crawford, *dolichos* Fox), have been described from Florida. *C. quercina* Cockerell is from Arizona; *C. ribis kincaidi* Cockerell is from Washington State; *C. aperta* Cresson, *coloradensis* Cresson, *erysimi* Cockerell, *deani* Cockerell, *grindeiæ denverensis* Cockerell and *crassula* Cockerell are from Colorado. *C. deplanata* Cresson occurs from Kansas to Utah and Washington State.

The remaining species are from the eastern and northeastern States, viz. *rufitarsis* Smith, *funeraria* Smith (Can.) *modesta* Smith, *octodentata* Say *alternata* Say, *sayi* Robertson, *rufitarsis melanopoda* Viereck, *germana* Cresson, *lateralis* Cresson, *lucrosa* Cresson, *mæsta* Cresson, *sodalis* Cresson (also Colo.), *comstockii*, Cresson (N. Y.), *immaculata* Cockerell (Ind.), *sculptifrons* Crawford (N. Y.), *banksi* Crawford (Va.), Robertson found seven species in Illinois (*sayi*, *modesta*, *germana*, *alternata*, *texana*, *rufitarsis*, *octodentata*).

There are in addition one new species from Virginia, one from Utah, Colorado and Wyoming, and two from Colorado, described above. It will be seen from the above that most of the records come from a few States, and there are many parts of the country from which the *Celiorys* are unknown.

CHELYNIA Provancher

Chelynia elegans (Cresson)

COLORADO: 5 ♀, Ward, about 9300 ft. alt., near town, August 8, 1919.

Chelynia monticola (Cresson)

IDAHO: 1 ♀, Bear Lake, along Fish Haven Creek at about 6200 ft. alt., July 9, 1920; 1 ♀, Giveout near Montpelier, about 6700 ft. alt., July 7, 1920; WYOMING: 3 ♀, Jackson, along Cache Creek from 6300 to 7000 ft. alt., July 15, 1920.

Chelynia subemarginata (Cresson)

IDAHO: 1 ♀, Bear Lake, along Fish Haven Creek at about 6200 ft. alt., July 9, 1920, collected by Mrs. F. E. Lutz. WYOMING: 1 ♀, 1 ♂, Jackson, along Cache Creek, at about 6300 ft. alt., July 15, 1920; collected by Mrs. F. E. Lutz. COLORADO: 1 ♂, Telluride, along the trail near Cornet Creek at about 11,000 ft. alt., July 9, 1919; 1 ♂, South Fork, about 37° 40' N., 106° 38' W. and 8200 ft. alt., June 17, 1919;

2 ♀, 2 very small ♂, Camp Creek Ranger Station at about 41° N., 106° 12' W., and 8700 ft. alt., July 19, 1921. All of these places are quite mesophytic, the Idaho one being the nearest approach to desert conditions. The specimens from Telluride and Camp Creek were taken not far from still-remaining snow.

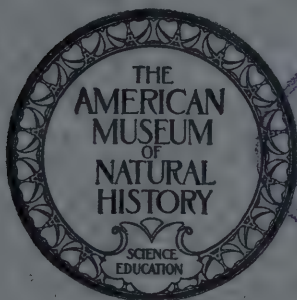
The males are very variable in size but appear to represent a single species.

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No. 22

NEW SPECIES OF NORTH AMERICAN LIZARDS OF THE GENERA *HOLBROOKIA* AND *UTA*

By KARL PATTERSON SCHMIDT



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NEW SPECIES OF NORTH AMERICAN LIZARDS OF THE GENERA *HOLBROOKIA* AND *UTA*

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In the course of an examination of the lizards belonging to the genera *Holbrookia* Girard and *Uta* Baird and Girard, I have found it necessary to recognize a number of new forms. In view of the necessary postponement of the publication of more complete reviews of these genera, I have characterized the new forms in the present preliminary paper and have included keys to the two genera which present in abstract the taxonomic conclusions to be discussed more fully in subsequent papers.

I am much indebted to the authorities of the United States National Museum, and especially to Dr. Leonhard Stejneger, Head Curator, Department of Biology, for the loan of valuable collections of *Holbrookias* and *Utas* from Mexico and the southwestern United States for study in connection with the collections of The American Museum of Natural History.

Holbrookia pulchra, new species

DIAGNOSTIC CHARACTERS.—A slender, medium-sized species, allied to *H. elegans*, with tail considerably longer than the body, the hind leg averaging about four-fifths of the body length; dorsal scales flat; ventral scales large, 59 to 70 from collar to anus; femoral pores few, average 11.6; dorsal spots usually sharply defined, the dorsal and lateral series often confluent, enlarged supraoculars and frontals separated by scales not much smaller than either.

MEASUREMENTS OF TYPE.—Length, 120 mm.; body, 56 mm.; tail, 64 mm.; tail/total length, .53; foreleg, 28 mm.; hind leg, 47 mm.

RANGE.—Huachuca Mountains of southern Arizona, east of Nogales.

TYPE.—A. M. N. H. No. 14777; Carr Canyon, 5200 ft.; Huachuca Mountains, Arizona; May 14, 1919; R. D. Camp.

Holbrookia maculata campi,¹ new subspecies

DIAGNOSTIC CHARACTERS.—Characters of *Holbrookia maculata*. Distinguished from *H. m. maculata* by coloration, which resembles that of *approximans*, and by the fewer, wider and more oblique upper labials, also as in *approximans*; distinguished from *m. flavilenta* by the same characters; distinguished from *m. approximans* by the longer tail and hind leg, especially of the female; tail/total length varies from .46 to .50 in ♀ *m. campi*, averaging .48, .42 to .48 in ♀ *m. approximans*, averaging .44; length of leg/body length ranges from .77 to .88 in ♀ *m. campi*, averaging .83, .65 to .78 in ♀ *m. approximans*, averaging .71.

¹Named for Mr. Charles Lewis Camp, the collector of the type series, and well known for his contributions to North American herpetology.

MEASUREMENTS OF TYPE.—Total length, 101 mm.; body, 53 mm.; tail, 48 mm.; tail/total length, 48; arm, 25 mm.; leg, 42 mm.

RANGE.—Probably the southern part of the Colorado Plateau in northern Arizona. Apparently not reaching Utah on the north, possibly entering New Mexico to the east. It is expected that it will be found to intergrade with *m. approximans* in central Arizona.

TYPE.—A. M. N. H. No. 7990; ♂, about 8 miles N. W. of Adamana, Apache County, Arizona; June 21, 1921; Charles L. Camp.

Holbrookia dickersonæ,¹ new species

DIAGNOSTIC CHARACTERS.—A large, stout bodied species, with a slightly flattened tail equal to or slightly shorter than the body; snout very obtuse; dorsal scales small, slightly convex; small granular scales between the enlarged supraoculars and the frontals; labials very short and at a high angle with the horizontal, strongly keeled, strongly projecting; femoral pores 9–13; coloration of *H. m. approximans*, but with three lateroventral black spots entirely surrounded by a patch of blue, which is equally distant from axilla and groin and covers more than half the distance between.

MEASUREMENTS OF THE TYPE.—Length, 116 mm.; body, 58 mm.; tail, 58 mm.; tail/length, .50; foreleg, 30 mm.; hind leg, 46 mm.

RANGE.—Known only from Castanuelas and Alamos de Parras in the state of Coahuila, Mexico.

TYPE.—U. S. N. M. No. 2668 A²; Castanuelas, Coahuila, Mexico; Lieutenant B. Couch, U. S. A.

KEY TO THE SPECIES OF *Holbrookia*

1. Tail flat with broad black ventral bands; lateroventral black marks placed far back, continued dorsally above the lateral fold (Central Texas to south and central Arizona.) *texana*.
Tail rounded; no black bands beneath tail (small black spots in one species); lateroventral marks more anterior, not present dorsally 2.
2. Tail longer than the body in both sexes 3.
Tail shorter than the body in the female, usually also in the male 5.
3. Dorsal scales very small, convex or keeled; a distinct area of supraocular granules between the enlarged supraoculars and the frontals; tail very long; dorsal spots usually indistinct. (Southern Texas.) *propinqua*.
Dorsal scales larger, flat; no distinct small supraoculars between the frontals and the central supraoculars; dorsal spots usually (not invariably) distinct, sharply outlined 4.
4. Size large, habitus robust, body frequently exceeding 60 mm.; femoral pores usually 12 or more. (Lower altitudes, Tucson, Arizona south along west coast of Mexico through Sinaloa.) *elegans*.
Size smaller, habitus slender, body less than 60 mm.; femoral pores usually less than 12. (High altitudes, above 5000 ft., Huachuca Mts., to Nogales and Bisbee, Arizona.) *pulchra*.

¹Named for Miss Mary C. Dickerson, former curator of the Department of Herpetology, American Museum of Natural History.

²U. S. N. M. No. 2668 covering four male specimens, I designate the type by means of a lettered tag A.

5. Subcaudal black spots usually present; scales flat, not tubercular in large specimens; dorsal spots very sharply defined, often digitate behind. (Coahuila, Mexico, southern and central Texas, possibly to Kansas.)

lacerata.

Dorsal spots rarely sharply defined; no subcaudal black spots; scales keeled or tubercular in large specimens.....6.

6. Three lateroventral black spots entirely surrounded by a blue patch. (Southern Coahuila, Mexico.).....*dickersonæ.*

Two or three lateroventral black spots, often margined with blue, but no extensive blue patch.....*maculata*—7.

7. Snout somewhat pointed, labials narrow, elongate; usually three or four scales between the enlarged nasals; a mid-dorsal light stripe usually and two dorsolateral and two lateral light stripes frequently present. (Wyoming and Nebraska, south to Texas.).....*maculata maculata.*

Snout more truncate, labials shorter, wider and more oblique to the horizontal; usually two or three scales between the enlarged nasals; no mid-dorsal light stripe.....8.

8. Usual dorsal pattern indistinct, replaced by small irregular light and dark spots; ground color very pale. ("White Sands" of southern New Mexico.)

m. flavilenta.

Large dark dorsal spots present, ground color darker.....9.

9. Tail shorter, .42-.50 of total in male, .42-.48 in female, hind leg shorter, .72-.83 in male, .65-.78 in female. (Northern Mexico, southern Arizona; ? southern Mexico.).....*m. approximans.*

Tail longer, .48-.51 in male, .46-.50 in female; hind leg longer, .79-.86 in male, .77-.88 in female. (Central and northern Arizona, probably the Colorado Plateau.).....*m. campi.*

***Uta wrighti*,¹ new species**

DIAGNOSTIC CHARACTERS.—Closely allied to *Uta ornata* and *Uta levis*; distinguished from the former by the small and smooth lateral basal caudal scales, about 32 in the fifth verticil behind the enlarged postnals; from the latter by the well developed dorsolateral line of tubercles, and the more strongly keeled dorsal scales.

MEASUREMENTS OF TYPE.—Total length, 125 mm.; snout to anus, 43 mm.; tail, 82 mm.; tail/total length, .66; foreleg, 19 mm.; hind leg, 29 mm.; length of head, 11.5 mm.; breadth of head, 8.5 mm.

RANGE.—Western Colorado and southeastern and southern Utah.

TYPE.—A. M. N. H. No. 18097; ♂; Grand Gulch, San Juan County, Utah; elevation between 4000 and 5000 ft.; November 9, 1920; B. T. B. Hyde.

***Uta gadovi*,² new species**

DIAGNOSTIC CHARACTERS.—Frontal entire, four to six rows of enlarged dorsal scales, abruptly larger than the granular scales with no granular scales on the vertebral

¹Named for Dr. A. H. Wright of Cornell University, to whom I owe my introduction to vertebrate zoology.

²Named for Dr. Hans Gadov, the collector, with especial reference to his important zoological explorations in southern Mexico.

line; dorsolateral line and lateral fold set with prominent tubercular scales,¹ with a row of tubercles between them; caudal scales strongly keeled, not spinose, in nearly uniform verticils.

MEASUREMENTS OF TYPE.—Total length, 134 mm.; snout to anus, 53 mm.; tail, 81 mm.; tail/total length, .60; foreleg, 20 mm.; hind leg, 30 mm.; length of head (to anterior border of ear), 11.5 mm.; breadth of head, 9.5 mm.

RANGE.—Jalisco and Michoacan, Mexico.

TYPE.—A. M. N. H. No. 20355; Cofradia, Jalisco, Mexico; 1902-1904; Dr. Hans Gadow.

Uta tuberculata, new species

DIAGNOSTIC CHARACTERS.—Allied to *Uta bicarinata*, with which it has hitherto been confounded; distinguished from *bicarinata* by: (1) the longer head and less sloping profile; (2) the much less sharply spinose ventrals; (3) smaller size, not reaching 50 mm. of body length; (4) more regular series of lateral tubercles; (5) larger preauricular spines.

MEASUREMENTS OF TYPE.—Total length, 105 mm.; snout to anus, 45 mm.; tail, 60 mm.; tail/total length, .57; foreleg, 19 mm.; hind leg, 27 mm.; length of head 12.0 mm.; breadth of head, 9.0 mm.

RANGE.—States of Colima and Jalisco, Mexico.

TYPE.—A. M. N. H. No. 13737; ♂; Colima, State of Colima, Mexico; March 28, 1919; Paul D. R. Ruthling.

Uta nelsoni,¹ new species

DIAGNOSTIC CHARACTERS.—A large species, with a high and short head, long limbs, and a rather elongate body; allied to *Uta bicarinata* and *U. tuberculata*. Ventral scales not mucronate; sides not distinctly tuberculate, not at all bristling in appearance; caudal scales irregular in size, in irregular whorls of three verticils each; dorsal series of enlarged scales beginning on the nape, interrupted on the shoulders.

MEASUREMENTS OF TYPE.—Total length (tail reproduced), 128 mm.; snout to anus, 58 mm.; foreleg, 23 mm.; hind leg, 33 mm.; length of head, 13.5 mm.; breadth of head, 10.5 mm.

RANGE.—Known only from the type locality.

TYPE.—U. S. N. M. No. 46836; ♂; Cuicatlan, Oaxaca, Mexico; October 9, 1899; E. W. Nelson and A. E. Goldman.

KEY TO THE SPECIES OF *Uta*

1. Dorsal scales very small, perfectly smooth; enlarged supraoculars in more than one row.....2.
- Dorsal scales less than 40 in the length of the head, at least faintly keeled posteriorly; enlarged supraoculars in one row.....3.
2. Caudal scales small, smooth. (Southern Lower California.)*thalassina*.
Caudal scales large, keeled, spinose. (Northern Lower California.)*mearnsi*.
3. Dorsal scales nearly uniform, graduated into the smaller laterals.....4.
Dorsal scales with a few median rows abruptly enlarged.....14.

¹Named for Dr. Edward W. Nelson, Chief of the Bureau of Biological Survey, U. S. Dept. of Agriculture, with especial reference to his contributions to the scientific exploration of Mexico.

4. Frontal entire.....5.
Frontal transversely divided.....6.
5. Dorsal scales very small, about 35 in head length. (Northern Lower California.)
microscutata.
Dorsal scales larger, a broad band of enlarged scales down the back (see also 23).
(Southern Lower California.).....*nigricauda*.
6. Gular scales about 40; femoral pores 17. (San Pedro Martir Island, Gulf of California.).....*palmeri*.
Gular scales less than 35; femoral pores less than 17.....7.
7. Hind leg short, .71 to .72 of the body length; dorsal scales very weakly keeled..8.
Hind legs more than .72 of the body length; dorsal scales more sharply keeled..9.
8. Femoral pores average 13; dorsal scales average 103 from occiput to rump.
(Utah and Nevada.).....*stansburiana stansburiana*.
Femoral pores average 15; dorsal scales average about 115. (San Benito Islands, off Pacific Coast of Lower California.).....*stellata*.
9. Dorsal scales largest in the group, 70-78 from occiput to rump; hind leg .79 of the body length; femoral pores average 15. (Santa Catalina Island, Gulf of California.).....*squamata*.
Dorsal scales average more than 80.....10.
10. Hind leg averages .80 of the body length. (Southern Lower California.) *elegans*.
Hind leg averages .74 to .75 of the body length.....11.
11. Dorsal scales average about 86. (Southeastern California to western Texas and adjacent areas in Mexico. Angel de la Guardia Island.)
stansburiana stejnegeri.
Dorsal scales average more than 90.....12.
12. Size large, snout to anus 62 mm. (San Martin Island, off Pacific Coast of Lower California.).....*martinensis*.
Smaller, usually not exceeding 50 mm. in body length.....13.
13. Dorsal scales strongly keeled, average about 100; posterior femorals strongly keeled. (Southwestern California, San Joaquin Valley and Northwestern Lower California.....*stansburiana hesperis*.
Dorsal scales weakly keeled, average about 92; posterior femorals weakly keeled. (Cedros and Natividad Islands off Pacific Coast of Lower California.)
concinna.
14. Frontal transversely divided.....15.
Frontal entire.....23.
15. Enlarged dorsal scales nearly uniform, with no series of small scales on vertebral line; tail long, about two-thirds of total. (Southern Nevada, southeastern California, and southwestern Arizona.).....*graciosa*.
One or more vertebral series of small scales.....16.
16. No tubercular scales forming a well defined dorsolateral line; enlarged dorsals nearly smooth.....17.
A well defined dorsolateral row of tubercles.....18.

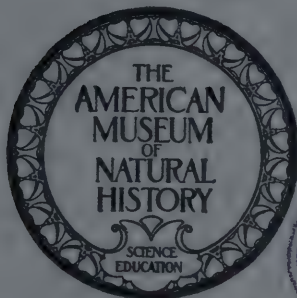
17. A few enlarged scales on the dorsolateral line; upper posterior scales on thigh smooth. (Socorro Island, Revilla Gigedo Islands.) *auriculata*.
No enlarged scales on the dorsolateral line anteriorly; upper posterior femorals keeled. (Tierra Amarilla, New Mexico.) *levis*.
18. Lateral scales at base of tail small, leaving four abruptly enlarged dorsal rows of caudals; 30-34 scales in the fifth verticil behind the enlarged postanals. (Southeastern Utah.) *wrighti*.
Lateral caudal scales larger, less than 30 in the fifth verticil. 19.
19. Enlarged dorsals beginning well forward on the nape. 20.
Enlarged dorsals beginning on the shoulders. *ornata*—21.
20. Enlarged dorsals anteriorly in one row on each side; dorsolateral tubercles small. (Tres Marias Islands; Sinaloa and Sonora, Mexico.) *lateralis*.
Enlarged dorsals anteriorly in two rows on each side; dorsolateral tubercles very large, close set. (Clarion Island, Revilla Gigedo Islands.) . . *clarionensis*.
21. Enlarged dorsal scales more or less irregular in size and arrangement; no oblique series of tubercles between the dorsolateral line and the lateral fold. (West-ern Texas, New Mexico and Chihuahua, Mexico.) *ornata ornata*.
Enlarged dorsal scales in four very regular rows; oblique series of tubercles on the sides. 22.
22. Enlarged dorsals continuous with caudals; tubercular scales and basal caudals spinose; general appearance bristling. (Southeastern Arizona and ad-jacent area in Sonora, Mexico.) *ornata linearis*.
Tubercular scales and caudals less spinose; enlarged dorsals reduced on rump. (Southeastern California and southwestern Arizona.) . . *ornata symmetrica*.
23. No dorsolateral line of tubercles. (Southern Lower California) *nigricauda*.
A well defined series of dorsolateral tubercles, at least posteriorly 24.
24. No vertebral series of small scales separating the enlarged dorsals. 25.
One or more vertebral series of small scales separating the enlarged dorsals. . 26.
25. Four to six regular series of enlarged dorsals. (Jalisco and Michoacan, Mexico).
gadovi.
Two or three irregular series of very large dorsals. (Guerrero, Mexico.)
irregularis.
26. Ventral scales mucronate. (Oaxaca, Puebla, and Guerrero, Mexico.) . *bicarinata*.
Ventral scales very faintly, if at all, mucronate 27.
27. Enlarged dorsal scales beginning on the shoulders; lateral tubercles very distinct; scattered tubercles on neck. (Colima and Jalisco, Mexico.) . . . *tuberculata*.
Series of enlarged dorsal scales beginning on the neck; lateral tubercles in-distinct. (Cuicatlam, Oaxaca, Mexico.) *nelsoni*.

AMERICAN MUSEUM NOVITATES

No. 23

THE EPEOLINE BEES OF THE AMERICAN MUSEUM ROCKY MOUNTAIN EXPEDITIONS

By T. D. A. COCKERELL



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THE EPEOLINE BEES OF THE AMERICAN MUSEUM ROCKY MOUNTAIN EXPEDITIONS¹

By T. D. A. COCKERELL

This collection constitutes the most remarkable series of Epeoline bees which has ever reached my hands in a single consignment. The *Triepeolus* number 22 species, of which 16 are new; the *Epeolus* four species, with two species and a variety new. It appears that the Rocky Mountains constitute the greatest center for Epeolines in the world. In addition to the species now recorded, the following have been taken in Colorado:

- Epeolus beulahensis* Cockerell. (Type from New Mexico).
- “ *interruptus* Robertson. (Type from Illinois).
- “ *eldoradensis* Cockerell. (Type from Eldora, Colorado).
- “ *compactus* Cresson. (Type from Texas).
- Triepeolus helianthi grandior* Cockerell. (Type from Florissant, Colorado).
- “ *martini* Cockerell. (Type from New Mexico).
- “ *grindelæ* Cockerell. (Type from Boulder, Colorado).
- “ *denverensis* Cockerell. (Type from Denver, Colorado).
- “ *rhoweri* (Cockerell). (Type from N. Boulder Creek, Colorado).
- “ *subalpinus* Cockerell. (Type from Eldora, Colorado).
- “ *gabrielis* Cockerell. (Type from California).

Colorado has in all 32 species of Epeolines. The whole Nearctic Region has 76; the Neotropical over 70. The Old World is not nearly so richly supplied. From Europe we know 15 species; from Palæarctic Africa, 7; from the Ethiopian region, 10. From Asia nine species are recorded; from the Australian region none. There are none in the Malay Islands; the Borneo record in Dalla Torre's Catalogue is an error. Two species occur in India (*E. peregrinus* Cockerell, *E. fervidus* Smith) and one (*E. assamensis* Meade-Waldo) in Assam. *E. ventralis* Meade-Waldo is found in China. In southern South America the genera *Isepeolus* Cockerell (9 species), *Doeringiella* Holmberg (6 species), and *Trophocleptria* Holmberg (2 species) represent a considerable diversification of the Epeoline fauna, but Bréthes considers that Holmberg's two genera should not be separated from *Epeolus*. Ducke in this matter follows Bréthes, but these authors take *Epeolus* in a broad sense, not separating

¹Unless otherwise stated, the bees reported upon in this paper were collected by Frank E. Lutz and the field notes are by him.

Triepolus. *Leiopodus* Smith, with two Neotropical species, is related to *Isepeolus*. These two genera are not very near to *Epeolus*.

I consider *Triepolus* a very good genus, apparently confined to the New World. It appears to live in the nests of Anthophoridae, whereas *Epeolus* lives with *Colletes*. Gribodo (1894) described a subgenus *Diepeolus* for the Algerian *E. giannellii* Gribodo, having two free joints to the maxillary palpi instead of one. In general, the species resembles *E. fallax* Morawitz. *Argyroselenis* Robertson appears to be a synonym of *Diepeolus*, but the type species of the Algerian and American groups should be compared.

***Triepolus concavus* (Cresson)**

COLORADO: 2 ♂, 4 ♀, Wray, about 3700 ft. alt., some at *Helianthus*, August 17-19, 1919; 4 ♂, 2 ♀, La Junta, about 4100 ft. alt., along the edges of irrigated fields, August 12, 1920, collected by Mrs. F. E. Lutz; 1 ♂, Pueblo, in vacant lots in the city, August 9, 1920.

This species is new to Colorado.

***Triepolus concolor* (Robertson)**

COLORADO: 3 ♀, La Junta, about 4100 ft. alt., along the edges of irrigated fields, August 12, 1920, collected by Mrs. F. E. Lutz.

This is the first record from Colorado.

***Triepolus lunatus* (Say)**

COLORADO: 1 ♀, Wray, about 3700 ft. alt., in the moist valley of Dry Willow Creek, August 18, 1919; 3 ♀, 1 ♂, La Junta, about 4100 ft. alt., along the edges of irrigated fields, August 12, 1920, collected by Mrs. F. E. Lutz.

Not previously recorded from Colorado.

***Triepolus pectoralis* Robertson**

COLORADO: 2 ♂, 1 ♀, Wray, about 3700 ft. alt., in the moist places (1 male taken by evening sweeping along the river), August 19, 1919; 1 ♂, Pueblo, in vacant lots in the city, August 9, 1920; 1 ♂, Boulder, about 5300 ft. alt., on the plains between the town and Boulder Lake, August 12, 1919; 1 ♂ (mesothoracic stripes pointed in front, not reaching margin of mesothorax), Grand Junction, about 4500 ft. alt., along an irrigating ditch, August 3, 1920.

The first records from Colorado.

***Triepolus pænepectoralis* Viereck**

COLORADO: 2 ♂ (labrum red; clypeus without a median line; longitudinal bands of mesothorax widely separated from lateral patches), Wray, about 3700 ft. alt., dry, sagebrush country, August 17, 1919; 1 ♂ (labrum red; clypeus with a median shining line; longitudinal bands of mesothorax broad and not far distant from the large patches), Fruita, not far from Grand Junction, about 4500 ft. alt., at *Helianthus* along the road, July 16, 1919.

Not hitherto reported from Colorado. *T. pænepectoralis* from Washington State, as I have recognized it, is variable, and I am not able to separate the Colorado specimens as a distinct species. It is, however, quite possible that more material would justify the segregation of one or even two species.

***Triepeolus fortis*, new species**

COLORADO: 1 ♀, Wray (type locality), about 3700 ft. alt., in the cottonwood area at the head of Dry Willow Creek, August 18, 1919; 2 ♂, La Junta, about 4100 ft. alt., at the edge of an irrigated field, August 12, 1920, collected by Mrs. F. E. Lutz.

♀ (Type). Length about 14 mm.; robust, black, with cream-colored markings; first three antennal joints (except on inner side), labrum and mandibles dark red; legs bright chestnut red; tegulae dark reddish marked with black, the general effect dark; axillae black. Head broad; eyes purplish, with upper third green; clypeus very densely and minutely punctured, with some scattered shallow large punctures, and a smooth median line; third antennal joint much shorter than fourth; mesothorax dull and granular, with an ochreous border (except in middle anteriorly) and a pair of dagger-shaped well-separated bands, their broad bases resting on the anterior border and continuous with the ochreous margin laterad; scutellum bigibbous, axillae stout and rather long; pleura densely granular and dull, mainly naked, but with pubescence behind the tubercles and a lobe extending backward at level of lower end of tubercles; area of metathorax with two shining spaces, separated by a dull T; wings strongly brownish, stigma and nervures dark brown; spurs black; hair on inner side of hind basitarsi dark, the tarsi also conspicuously darker than tibiae; abdominal bands broad and entire, except the basal one on first segment; black area on first segment a transverse band, but its upper side convex, so that it is elongate-semilunar (but the lower side straight) and intermediate between the two types; lateral angles of black on second segment very acute; fifth segment without light hair at sides, its pygidial patch large and triangular; venter without pubescence; last ventral segment neither elongated nor concave in lateral profile.

♂. Smaller; clypeus not covered with hair, but dense white hair at sides of face; antennae black with third joint reddish on outer side; femora varying to mainly black; band at apex of first abdominal segment narrowly interrupted; apical plate broad and dark.

A very fine species, resembling *T. helianthi grandior* Cockerell but considerably larger and more robust, with longer axillae and broader apical plate of abdomen. The head is broader than in *grandior* and the pygidial patch is much broader apically.

***Triepeolus helianthi* Robertson**

The specimens separate into two lots, the larger or typical form, and a smaller variety or race, 8.5–9.5 mm. long. The latter is probably parasitic on a smaller host-species, but it seems to have no special character aside from size. Perkins observed that the British *Epeolus cruciger* Panzer lived with *Colletes succincta* and *C. marginata*, and those with the latter species were found to be of smaller average size.

Larger Race

COLORADO: 1 ♀, Wray, about 3700 ft. alt., at *Helianthus*, August 18, 1919; 3 ♀, La Junta, about 4100 ft. alt., along roadsides, August 12, 1920, collected by Mrs. F. E. Lutz; 1 ♀, Glenwood Springs, about 5800 ft. alt., among sweet-clover and sunflowers near town, August 5, 1920.

Smaller Race

COLORADO: 1 ♀, 1 ♂, Wray, about 3700 ft. alt., on dry upland near town, August 17, 1919; 2 ♀, La Junta, about 4100 ft. alt., along roadsides, August 12, 1920, collected by Mrs. F. E. Lutz; 1 ♀ (July 29, 1919), 1 ♂ (August 5, 1920), Glenwood Springs, about 5800 ft. alt., among sweet-clover and sunflowers near town; 1 ♀, Palisades, not far from Grand Junction, about 4740 ft. alt., July 18, 1919, collected by Pearce Bailey, Jr.; 1 ♀, Rifle, about 5400 ft. alt., at edge of swamp along R. R., July 20, 1919, collected by Herbert F. Schwarz; 1 ♀, 1 ♂, Boulder, about 5400 ft. alt., in town (collected by Pearce Bailey, Jr.) and on the plains near Boulder Lake, August 7-12, 1919.

The two races do not seem to have been living in different environments. The males run in my key in Journ. N. Y. Ent. Soc., XXVII, p. 300, to subspecies *pacificus* Cockerell, except that they are smaller, with more slender antennæ. They belong to the smaller race, whereas *pacificus* type is of the larger. I gather from Robertson's account that both sexes of his *helianthi* have the pleura marked alike; I have only a female from him. It remains to be decided whether I should not have separated *pacificus*, or whether all the Colorado specimens (excluding *grandior*) should be referred to it, as a distinct western subspecies.

Triepeolus schwarzi,¹ new species

COLORADO: 3 ♂, Meeker, about 6200 ft. alt., at *Grindelia serrulata*, July 21, 1919.

♂. Length 8-9 mm.; black, with cream-colored ornaments; labrum and mandibles (except apex) red; face with dense snow-white hair; clypeus densely granular and dull without a smooth line; eyes very pale grayish-green; sides of vertex with large punctures; antennæ black, third joint obscurely reddish; mesothorax with hair-band round margin (except in anterior middle) and two very broad parallel well separated bands (not sharply defined) reaching beyond center, for half their length connected with lateral bands by a thin inconspicuous pubescence; scutellum flattened; axillæ small, black; pleura densely covered with creamy-white hair, except on area above middle coxæ; tegulæ dull apricot-color; wings hyaline, brownish apically, nervures and stigma piceous; legs clear bright ferruginous; spurs black; abdominal bands broad and entire, but that on first segment, or first three segments, notched in front; black area on first segment a transverse band, obtuse at sides; angles of black at sides of second segment rounded, but at end of a long sinus, the lobes of hair-bands being long and pointed, directed mesad; apical plate

¹Named after Mr. Herbert F. Schwarz, who was a member of the 1919 expedition, and has done much work on the bees collected.

red, very narrow; venter with appressed silvery-white hair, forming a broad triangle on first segment, and very broad bands (not emarginate posteriorly) on second and third.

A neat little species, running in my table in Ann. Mag. Nat. Hist., January 1904, to *T. isocomæ* Cockerell, but the markings are differently colored, the labrum is different, the scutellum different, etc. There is real affinity with the Californian *T. callopus* Cockerell, but the tubercles and clypeus are black, and there are other differences. It differs from *T. rohweri* Cockerell by the entirely red anterior femora and tibiæ (black in *rohweri*) etc.

***Triepeolus balteatus*, new species**

COLORADO: 1 ♂ (the type), Denver, August 28, 1919, collected by Barbara M. and Marjorie D. Schwarz; 1 ♂, White Rocks, an interesting cretaceous formation in the plains near Boulder, about 5200 ft. alt., at *Solidago*, August 13, 1919, collected by Mrs. T. D. A. Cockerell.

♂. Length about 9 mm.; black, including labrum, mandibles (except dark red band in middle), antennæ (third joint dark red on outer side), tubercles and axillæ; tegulæ pale testaceous; legs bright ferruginous, with black spurs; eyes entirely pea-green; face densely covered with silver-white hair, but pubescence in general cream-color; mesothorax covered with not very dense appressed hair, the two bands (parallel and reaching anterior margin) indicated by denser hair, but not very evident, posteriorly a dark semicircle (the concavity cephalad) indicates a nearly bare region; scutellum rather feebly bilobed, axillæ short; pleura densely covered with silvery-white hair; wings hyaline, faintly dusky, stigma and nervures piceous; hair on inner side of hind tarsi light orange (it is black in *T. isocomæ*); abdominal bands broad and entire; first segment with a transverse dark band, narrow, obtuse at ends; lateral angles of black on second segment right angles; apical plate dark reddish, broader than in *T. schwarzi*, its sides not parallel; second and third ventral segments with broad bands of silvery hair, not emarginate posteriorly.

Allied to *T. denverensis* Cockerell but much smaller, with the sides of the second abdominal segment entirely covered with light hair, the hair on pleura white instead of creamy, etc.

***Triepeolus rhododontus*, new species**

COLORADO: 1 ♂, Wray, about 3700 ft. alt., at the head of Dry Willow Creek, August 18, 1919.

♂. Length about 9.5 mm.; black, with labrum (except basal middle), mandibles (except apex), tubercles, ends of axillæ and legs ferruginous, the hind femora with a large blackish patch in front; clypeus bare, dully minutely rugosopunctate, without a median line or ridge; face otherwise densely covered with pure white hair; eyes pale gray; antennæ black; mesothorax dull and rough, margined with ochreous hair except in anterior middle, the stripes dagger-shaped but not sharply defined, with the broad base on anterior margin; scutellum moderately bilobed; axillæ dentiform, curved, acute; pleura with a crescentic transverse band of white hair, the space below it nearly bare and strongly punctured, with a shining median area; tegulæ apricot-

color, dull; wings brownish, stigma and nervures piceous, marginal cell rather unusually short and broad; spurs black; hair on inner side of hind tarsi fulvous; abdomen with pale ochreous bands, only that at base of first segment interrupted, but that at apex of first notched before and behind, almost interrupted; black area on first segment a transverse band, rounded at sides; lateral angles of black on second acute, the lateral hair-patches pointed mesad; apical plate red, parallel-sided; venter largely reddish, but second segment black except the broad margin, a crescent of thin whitish hair at each side of second and third segments.

Allied to *T. occidentalis* Cresson (a specimen from Cresson's collection compared) but distinguished by the red labrum, tubercles and axillæ, the smooth space on pleura, the narrow, parallel-sided apical plate, etc.

***Triepeolus* (*Synepeolus*, new subgenus) *insolitus*, new species**

COLORADO: 1 ♂, Pueblo, in a vacant lot in town, August 9, 1920.

♂. Length about 12 mm.; robust; black, including antennæ, tubercles and axillæ, but labrum and median band on mandibles red; legs chestnut red, the anterior femora black except at apex, spurs black, hair on inner side of basitarsi black; tegulæ piceous, dark rufous posteriorly. Head broad; eyes with lower half purplish, upper half green; clypeus exposed, very densely and minutely punctured, with a smooth median line and a few scattered large punctures; face at each side of antennæ with a longitudinal band of white hair, but on front and between antennæ it is dark grayish; third antennal joint obscurely rufous at end; thorax and abdomen with ochreous ornaments; black area on mesothorax anchor-shaped, the lateral arms or lobes very broad, the bands of ochreous hair pointed posteriorly (style of *T. fortis*, but stem of anchor more slender); scutellum bilobed, axillæ short and obtuse; wings brownish, stigma and nervures piceous; only two submarginal cells, the second transverse cubital absent, but first recurrent nervure joining second submarginal cell near base, the second submarginal cell not as long as if a typical *Triepeolus* had lost a nervure; the first transverse cubital is transverse, not oblique as in typical *Triepeolus*; pleura densely punctured, with a pale dull-ochreous L-shaped pubescent mark; abdomen with rather narrow ochreous bands, that at base of first segment broadly interrupted, that on apex of first emarginate anteriorly and posteriorly, that on second slightly emarginate posteriorly; dark area on first segment shaped nearly as in *T. fortis*, but not so broad, and truncate at sides, the pale pubescence at sides of segment nearly twice as broad as that at apex; angles of black at sides of second segment slightly acute, the lateral hair-patches broadly rounded; apical plate dark reddish, fairly broad, with concave margins; venter black, with a little white hair in middle of fringes on fourth and fifth segments, and sixth red in middle.

Resembles *T. fortis*, but smaller, with red middle and hind femora, much shorter fourth antennal joint, etc. From the position of the first transverse-cubital nervure, the condition of two submarginal cells is evidently normal and the insect falls in a new subgenus, which may be called ***Synepeolus***, from the united submarginal cells. *Phileremus americanus* Cresson is not related, but is an *Epeoline* with two submarginal cells. Ducke (1908) called it *Epeolus americanus*.

***Triepeolus brunneus*, new species**

COLORADO: 1 ♀, Lawn Lake, Rocky Mountain National Park, about 10,000 ft. alt., August 22, 1919, collected by Herbert F. Schwarz.

♀. Length about or a little over 9 mm.; rather robust; black, with cream-colored ornaments, but the usually black areas on mesothorax, scutellum, pleura and abdomen wood-brown from a covering of fine pile, but the area of metathorax exposed and black, the hair at sides of metathorax white; a large tuft of pale orange hair proceeding from behind each wing mesad over sides of postscutellum; cheeks with a strong abrupt keel behind. Labrum black; mandibles red in middle; clypeus very minutely and densely punctured, with scattered larger punctures, and no median smooth line; eyes purplish, greenish above; antennæ long, black, third joint red in front; prominence between antennæ strong; sides of face with white hair, becoming yellowish above; mesothorax with ochreous hair on lateral and posterior margins, and a pair of discal stripes, narrowed anteriorly but almost reaching anterior margin; scutellum faintly bilobed, axillæ very small, but pointed; tegulæ dark rufous, hairy; wings hyaline, slightly brownish apically; stigma and nervures rufous; marginal cell unusually short; upper part of mesopleura with white hair, lower part brown, the two colors not sharply separated; legs bright ferruginous, middle and hind spurs black; hair on inner side of hind tarsi pale orange; abdominal bands broad and entire, including basal one of first segment; brown area on first segment a transverse band with straight margins and obtusely rounded ends; lateral hair-patches rounded; pygidial area rather large, the segment covered with light hair on each side of it; venter brown without markings, the hind margins of the segments appearing very narrowly pallid; last ventral segment normal.

A very peculiar species, not close to any other, but similar brown pile may be seen in *Argyroselenis minima* Robertson, and to some extent in other Epeolines. It tends to be denuded as the specimens grow old.

***Triepeolus trilobatus*, new species**

COLORADO: 1 ♂, White Rocks (see above) near Boulder, about 5200 ft. alt., August 13, 1919.

♂. Length about or a little over 12 mm., robust; black, including labrum, mandibles (except red band in middle), antennæ, tubercles, axillæ and legs, the hind femora with a red spot behind near apex, and their tibiae with a large red patch on inner side apically; hair on inner side of hind tarsi rather pale chocolate; spurs black; ornaments of head and thorax cream-color, but hair at sides of face (not covering clypeus) pure white; eyes green, lower third purplish; clypeus dull and minutely granular, without a smooth line, its upper corners covered with brown hair; fourth antennal joint longer than fifth; mesothorax dull, margined with ochreous except in middle anteriorly, the black area like a large trilobed leaf, but the middle lobe long and narrow and reaching margin, the bands of pubescence pointed and not very long; scutellum bilobed; axillæ stout-conical; upper part of pleura with dense ochreous hair, more or less L-shaped (the transverse band very broad), the lower part black and dull, shining between the punctures in middle; tegulæ piceous, the margin reddish posteriorly; wings brownish, stigma and nervures piceous, first recurrent nervure reaching second submarginal cell a little before middle; middle tibiae with a stripe of shining fulvous hair on outer side; abdomen with broad entire bands, basal one on

first segment narrowly interrupted; black area on first segment a broad triangle; lateral corners of black on second segment acute, the edge of the pubescence above (cephalad of) them convex; band on sixth segment white; apical plate broad, very dark reddish; venter black, margins of third segment with silver-white hair laterally.

Resembles *T. concolor* Robertson, but differs greatly in ornamentation of mesothorax, which is similar to that of *T. fortis*. The apical plate is more narrowed apically than in *fortis*, but the relationship is very close, much like that of *concolor* to *lunatus*. Robertson described *concolor* in 1898 as a variety of *lunatus*, but in 1903 treated it as a distinct species.

***Triepeolus perelegans*, new species**

ARIZONA: 1 ♂, Comobabi Mts., about 32° 1' N., 111° 42' W., on the road from Haynes Well to the Indian village of Cobabi, about 3400 ft. alt., mesquite-acacia country, August 9, 1916.

♂. Length about 10 mm.; slender; black, with first three antennal joints and base of fourth, and all the legs, very bright ferruginous; spurs black (red in *T. hopkinsi* Cockerell), hair on inner side of hind tarsi orange; labrum red, mandibles suffusedly reddish; tubercles and axillæ black; ornaments very pale, with a creamy tint, hair of face, upper part of pleura and sixth abdominal segment white; eyes green, purplish at lower end. Clypeus with the disc flattened, shining, very minutely punctured, with scattered larger but not strong punctures; mesothorax glistening, black, with a pair of rather short, widely separated stripes, not reaching anterior margin; marginal band only along posterior side, and a patch before each tegula; scutellum bilobed, axillæ very inconspicuous; pleura with white hair above, below shining, with well-separated punctures; tegulæ bright ferruginous; wings hyaline, slightly brownish, stigma ferruginous, nervures fuscous; first recurrent nervure joining second submarginal cell beyond middle; abdomen with the bands very slightly yellowish, approaching pure white, basal and apical ones on first segment with linear interruptions, the others entire; black area on first segment a broad transverse band the ends oblique; lateral angles of black on second acute, the lateral hair-patches rounded; apical plate rather broad, very dark reddish; venter with bands of silver-white hair (successively narrower, and not emarginate posteriorly) on segments 2 to 4, the two fringes of curled hairs pale brown (the second darker than the first), some silver-white hair at sides of margin of fifth segment.

A pretty and distinct species, known from *T. hopkinsi* Cockerell, from the Grand Canyon of the Colorado, by the color of the spurs, the sparsely punctured lower part of pleura, etc. *T. pimarum* Cockerell, also from Arizona, has the clypeus red, and the mesothorax red with a broad median black band.

***Triepeolus sequior*, new species**

COLORADO: 1 ♂, Ridgeway, about 7000 ft. alt., sagebrush country, July 15, 1919, collected by Herbert F. Schwarz.

♂. Length about 9.5 mm.; black, including labrum, mandibles (except dark red median band), antennæ, tubercles, axillæ and spurs, but legs bright ferruginous,

with anterior femora (except knees) and their tibiae in front (except apex) black; hair on inner side of hind tarsi pale orange; ornaments cream-color, but face densely covered with silver-white hair, though the band on sixth abdominal segment is colored like the rest; eyes entirely dull pale green; fourth antennal joint conspicuously longer than fifth; mesothorax bordered with rather long and shaggy ochreous hair, the band very narrow along posterior middle, but not broken in middle anteriorly, the longitudinal bands pointed dentiform projections, the black area anchor-shaped; scutellum bigibbous; axillae small; mesopleura densely covered with creamy-tinted hair; tegulae piceous, with narrow obscure reddish margins; wings brownish, stigma and nervures (except basally) piceous; abdomen with all the bands broad and entire except that on apex of first, which is narrowly interrupted, the black area on first segment a transverse band; lateral angles of black on second acute (about 50°). The lateral patches of hair pointed, with the side above the angle straight (in *T. perelegans* it is convex); apical plate dark red, narrow; second and third ventral segments with very broad pure white hair-bands, slightly notched in middle posteriorly; fourth with white hair basally the two long curled fringes dull pale yellowish (dark fuscous at ends in *T. rhododontus*).

An ordinary-looking species, easily known from small examples of *helianthi* by the entirely hairy pleura, in the manner of *T. cressoni* Robertson. From *T. fraseræ* (Cockerell) it is easily known by the smaller size, the narrowly (instead of widely) interrupted apical band on first abdominal segment, the ochreous band along front of mesothorax not interrupted, and the much narrower apical plate. *T. fraseræ* also has the anterior tibiae entirely clear red. *T. fraseræ* is from Beulah, New Mexico, in the Canadian Zone. *T. sequior* is from the Transition Zone, about 7000 ft.

***Triepeolus rectangularis*, new species**

UTAH: 1 ♀, 1 ♂, Huntsville, near Ogden, July 26, 1920.

♀. (Type). Length about 11 mm., robust; black, including labrum, mandibles (except dark red median band), tubercles, axillae and legs, but small joints of tarsi red; third antennal joint (except basal two-thirds of inner side) and base of fourth bright chestnut red; tegulae piceous, the margin partly reddish; wings strongly dusky, stigma and nervures (except basally) piceous; outer transverse cubital angled and more or less appendiculate in middle; eyes dark purplish, the upper two-fifths light green; face at each side of antennae with appressed silvery hair; clypeus dull and minutely granular, with scattered large punctures, and a median ridge descending about three-fifths from the top; fourth antennal joint conspicuously longer than fifth; ornaments of thorax and abdomen cream-color; mesothorax with band along posterior and lateral margins, at anterior corners a quadrate patch of hair, emitting a nearly or quite obsolete bridge of hair to lateral stripes, thus enclosing a triangular black marginal area on each side; longitudinal stripes long and broad, diverging posteriorly, pointed, the base not quite reaching mesothoracic margin; scutellum bilobed, axillae short; pleura with a large L-shaped mark of light hair, but it is irregular, its upper part very broad, and extending beneath wings, while its lower edge is concave; lower part of mesopleura densely punctured but glistening; hair on inner side of hind tarsi

orange, on mid-tarsi tinged with coppery; spurs black; abdominal bands broad and entire, that on apex of first with a broken linear interruption; black area on first segment a transverse band, very obtuse laterally; lateral angles of black on second segment rectangles; false pygidium large, the segment on each side covered with pale hair; last ventral segment normal; venter without bands.

♂. Length about 8.5 mm., slender; red on antennæ reduced to apex of third segment and base of fourth; stripes on mesothorax shorter; mesopleura covered with pale hair; both bands on first abdominal segment narrowly interrupted, all the abdominal bands of the same color; apical plate piceous, narrow and parallel sided; second and third ventral segment with rather narrow bands of shining white hair, concave in middle and convex at sides, regarded from behind; the two fringes of curled hairs very dark; eyes entirely pea-green.

These look like different species but doubtless belong together. The sexual difference in the clothing of the pleura is similar to that in *T. cressoni* Robertson. This may be compared with *T. wyomingensis* Cockerell, a black-legged species with the lateral angles of black on second segment right angles. *T. wyomingensis* has a much larger male, without the red on antennæ, with a large part of pleura bare, and the white bands on venter very broad and quite different. It also has much longer, shaggy hair on mesothorax.

***Triepeolus amandus*, new species**

COLORADO: 1 ♂, Meeker, about 6200 ft. alt., at *Grindelia serrulata*, July 21, 1919.

♂. Length about or nearly 10 mm., rather slender; black, with very pale creamy-tinted ornaments, the band on sixth abdominal segment clear white; labrum, mandibles (except red median band), antennæ (except third joint partly reddened), tubercles, axillæ and legs (with spurs) black; face densely covered with silver-white hair; fourth antennal joint very slightly longer than fifth; mesothorax with rather loose ochreous hair forming a complete band all around, the longitudinal stripes hardly differentiated, the spaces laterad of them, nearly to their posterior ends, filled with hair, while the space between them is largely filled, though all this hair is rather thin; scutellum bilobed; axillæ small; mesopleura covered with white hair, slightly creamy above; tegulæ small, chestnut red; wings hyaline, faintly brownish apically, stigma and nervures (except basally) piceous; tibiæ and basitarsi with brilliant silvery-white appressed hair, middle tibiæ with a stripe of orange hair; hair on inner side of hind tarsi dusky ferruginous; abdomen with all the bands entire; black area on first segment a narrow transverse band, rounded at ends and sharply defined; lateral angles of black on second segment right angles; apical plate dark red, pointed; second and third ventral segments with broad white hair-bands; curled fringes very dark brown.

Also to be compared with *T. wyomingensis*, differing in the pointed apical plate, the broadly rounded ends of black band on first segment, the red tegulæ, etc. The upper appendiculation of third transverse cubital is wanting, whereas it is very prominent in *wyomingensis*.

***Triepeolus lestes*, new species**

COLORADO: 1 ♀, Glenwood Springs, about 5800 ft. alt., at edge of town, July 29, 1919, collected by Pearce Bailey, Jr.

♀. Length about 10 mm.; black, with black legs and cream-colored ornaments, small joints of tarsi obscurely pale reddish; eyes purplish with the upper third green; apex of third antennal joint on outer side dark red; fourth joint conspicuously longer than fifth. Similar to *T. rectangularis*, but differing thus: scattered punctures of clypeus fewer and much weaker, and no median ridge; stripes on mesothorax consisting of two elongated marks (style of *T. helianthi*), entirely isolated from the marginal band, which hardly goes mesad of the anterior corners; scutellum not distinctly bilobed; transverse band on pleura narrow and pointed; both hands on first abdominal segment narrowly interrupted; lateral hair-patches on second segment reduced to triangular projections from the band; transverse black band on first segment slightly bulbous at ends; false pygidium smaller.

***Triepeolus dichropus*, new species**

COLORADO: 1 ♂, Glenwood Springs, about 5800 ft. alt., at edge of town, July 29, 1919, collected by Herbert F. Schwarz.

♂. Length about 11.5 mm., robust; black, including labrum, mandibles (except median dark red band), antennæ, tubercles and axillæ; tegulæ piceous, dark rufous on outer side; hind tibiæ and tarsi bright ferruginous; all the knees, hind femora behind, anterior tibiæ apically, and their tarsi, more dusky red; spurs black; hair on inner side of hind tarsi orange; ornaments cream-color. A little pure white hair at each side of antennæ; clypeus dull and granular, with no median line, the scattered larger punctures few and shallow, mainly confined to the apical region; cheeks with a strong posterior keel; mesothorax glistening in middle, the marginal band narrow and weak, failing in anterior middle, and at sides of middle arching away from margin, the longitudinal stripes indistinct and short, but reaching anterior margin; scutellum bilobed, axillæ moderate; mesopleura dull, rugose, with a broad band of pale ochreous-tinted hair down its anterior margin, this sending only a small, curved, tooth-like projection backward; wings hyaline, faintly brownish, stigma piceous, nervures fuscous, paler basally; marginal cell long and unusually parallel-sided; outer transverse cubital angular; abdomen with broad entire bands, all of the same color; black area on first segment a broad transverse band, somewhat pointed at sides; band on second segment having at sides lateral lobes shaped like the last joint of a finger, standing at right angles to the band; apical plate piceous, rather narrow; second and third ventral segments with rather narrow bands of white hair, not emarginate posteriorly; curled fringes ochreous with dark tips.

An ordinary form in general aspect, but with many distinctive characters.

***Triepeolus maculiventris*, new species**

COLORADO: 1 ♀, Navajo Canyon in Mesa Verde National Park, about 6400 ft. alt., at *Helianthus petiolaris*, July 5, 1919.

♀. Length 10.3 mm.; black, with the labrum and mandibles dark red; tubercles and axillæ black; legs chestnut red, with the anterior femora black; spurs black; hair on inner side of hind tarsi orange, very short; tegulæ shining black; wings

hyaline, dusky apically, stigma and nervures black, the latter basally fuscous; ornaments cream-color, sharply defined, but face in region of antennæ with appressed white hair; clypeus finely and minutely punctured, but glistening, with scattered weak larger punctures, and a delicate smooth median line; antennæ black, third joint dusky reddish apically and on outer side; fourth joint longer than fifth; mesothorax with posterior marginal band broad behind tegulæ, but narrowing to a line in posterior middle; in front of tegulæ is a broad triangular-cuneiform patch, not joining posterior band or reaching anterior margin; longitudinal stripes distinct and clear-cut, lanceolate, parallel, not reaching anterior margin; scutellum feebly bigibbous, axillæ rather large, pointed; pleura with a clear-cut L-shaped mark, but it is excavated posteriorly behind tubercles, its lower (transverse) arm is parallel-sided and truncate; lower part of pleura densely punctured, but glistening between the punctures, except at upper end; abdomen with very distinct bands, both those on first segment narrowly interrupted, that on second slightly notched posteriorly; black area on first segment a broad band, obliquely truncate at ends; lateral angles of black on second segment broadly rounded, but the lateral marks are obliquely directed mesad, their outer face very convex, the inner straight; false pygidium moderate, with a large clear-cut triangular patch on each side; venter black, with a sharply-defined patch of white hair at each side of margin of third segment, and a pair of linear marks on fourth; eyes pale green, the lower third purplish.

Distinct by the pattern of the mesothorax, and white spots on venter, together with the red legs and dark tegulæ. The last ventral segment is normal, not concave in lateral profile.

***Tripeolus laticaudus*, new species**

COLORADO: 1 ♀, Cascade, Ute Pass, August 22, 1914, collected by D. M. Fisk.

♀. Length 9 mm., slender; black, including labrum (except a pair of obscure red spots), mandibles (except broad red band), antennæ (except reddish apex of third segment), tubercles and axillæ; tegulæ lively red, with a large black spot in front, and broad hyaline margins; legs bright red, but anterior femora black except apex and a stripe beneath, and middle femora black above, spurs black; hair on inner side of hind tarsi very pale yellowish; eyes pale green, with a grayish or purplish area below middle, but hind margins broadly green throughout; ornaments cream-color, but white hair around antennæ. Clypeus shining, very finely punctured, with scattered weak larger punctures, but no median smooth line, the basal two-thirds of middle flattened; fourth antennal joint longer than fifth; mesothorax rugose, with the marginal band feebly developed, the discal stripes long and narrow, parallel and wide apart, very nearly reaching anterior margin; scutellum strongly bigibbous; axillæ large; pleura with an L-shaped mark, but the broad lower arm curved, the convexity below; the ochreous hair extends down the front of mesopleura below the corner of the L; lower part of pleura densely and finely punctured, not shining; wings brownish hyaline, stigma and nervures black; abdomen with bands rather narrow, apical one on first segment rather widely interrupted in middle, that on second with a linear interruption; black area on first segment a very broad band, obliquely truncate at sides, but the outermost ends obtuse; lateral hair-marks on second segment reduced to isolated oblique spots, not united with the band; false pygidium very large; last ventral segment normal; venter with weak hair-bands on segments 2 to 4, and the fifth covered, except at sides, with pale appressed hair.

Known by the abdominal pattern, and especially the pale hair on last ventral segment; the tegulæ also are very distinctive.

***Triepeolus alpestris*, new species**

COLORADO: 1 ♀, Leadville, about 10,200 ft. alt., in vacant lots in town at *Lepidium alyssoides*, August 4, 1919, collected by Herbert F. Schwarz.

♀. Length 9 mm.; black, including labrum, mandibles (except obscure red band), antennæ (except red outer side and apex of third joint), tubercles and axillæ; tegulæ shining rather dark red; wings brownish hyaline, stigma and nervures black; marginal cell appendiculate at end; eyes with lower third purplish, upper two-thirds pale green; anterior legs black with small joints of tarsi red; middle femora black above and red beneath, their tibiæ black, except at apex; hind femora red, with a dusky band along anterior side, their tibiæ black, reddish on inner side; middle and hind basitarsi black, small joints red; spurs black; hair on inner side of hind tarsi appearing copper- ed seen from one direction, pale yellow seen from another; clypeus dully minutely punctured, with scattered very weak large punctures, and no median line; ornaments cream-color, but white hair at sides of face; mesothorax with anchor-shaped black area, the lateral bands in front pointed mesad, and only separated by a line from the broad-lanceolate discal marks, which do not reach anterior margin; scutellum convex, feebly bigibbous; axillæ small; pleura covered with hair, except the disc below, which is densely punctured and dull, the exposed area not distinctly defined; abdominal bands entire except the apical one on first segment, which has a linear interruption; black area on first segment a transverse band, evenly rounded at ends; lateral angles of black on second segment approximately right angles; pygidial area moderate; last ventral segment normal; venter with thin pale hair-bands on second and third segments. Known by the pattern of mesothorax and abdomen, combined with the color of legs and character of mesopleuræ.

It is allied to *T. townsendi* Cockerell, from the White Mountains of New Mexico, but easily separated by the much darker legs and the broad second submarginal cell. In *townsendi* the longitudinal stripes of mesothorax continue broadly to the anterior margin. Comparison may also be made with *T. concinnus* Cockerell from Northern Mexico, but that is larger, with yellower markings, and the middle and hind femora and tibiæ entirely bright red.

The above species of *Triepeolus* bees may be separated by means of the following table. I include also the few species of *Epeolus*.

- | | |
|--|--------------------------------|
| Scutellum red..... | <i>E. bifasciatus</i> Cresson. |
| Scutellum black..... | 1. |
| 1. Legs black..... | 2. |
| Legs at least mainly or largely red..... | 9. |
| 2. Large species, with mesothorax broadly ochreous-haired anteriorly, without longitudinal stripes; apical ventral segment of ♀ strongly concave in lateral profile..... | <i>T. concavus</i> (Cresson). |
| Mesothorax with two longitudinal stripes, or if these are indistinct, species small; apical ventral segment of known females not concave in lateral profile.... | 3. |

3. Black area on first abdominal segment triangular or subtriangular 4.
Black area on first abdominal segment a transverse band 6.
4. Length under 10 mm.; stripes on mesothorax not separated from light hair of margin *E. utahensis* Cockerell.
Length 10 mm. or more 5.
5. Stripes on mesothorax small and entirely isolated . . . *T. concolor* (Robertson).
Stripes on mesothorax continuous with marginal pubescence.
T. trilobatus Cockerell, ♂.
6. Tegulae dusky red; no separate stripes on mesothorax . . *T. amandus* Cockerell.
Tegulae black or almost; distinct stripes on mesothorax 7.
7. Venter with two very distinct white hair-bands . . . *T. rectangularis* Cockerell. ♂.
Venter without white hair-bands 8.
8. Clypeus with a median ridge, and very large scattered punctures.
T. rectangularis Cockerell, ♀.
Clypeus with no median ridge, and small scattered punctures.
T. lestes Cockerell, ♀.
9. Dark area on first abdominal segment triangular or subtriangular 10.
Dark area on first abdominal segment a transverse band 11.
10. Tegulae black or piceous; only two submarginal cells . . . *T. insolitus* Cockerell.
Tegulae dusky red; dark area on first segment somewhat intermediate in type; three submarginal cells *T. fortis* Cockerell.
Tegulae clear red *T. lunatus* (Say).
11. Dark areas of abdomen entirely covered with brown pile; tegulae red; labrum black *T. brunneus* Cockerell.
Abdomen normal 12.
12. Mesothorax without distinct stripes; small or smallish species; tegulae red or testaceous; pleura densely covered with light hair 13.
Mesothorax with distinct stripes, but they reach anterior margin 14.
Mesothorax with a pair of entirely isolated stripes 22.
13. Over 8 mm. long; lateral angles of black on second abdominal segment right angles or larger *T. balteatus* Cockerell.
Less than 8 mm. long; lateral angles of black on second segment acute.
E. lutzi Cockerell.
14. Longitudinal stripes of mesothorax joining marginal band of pale pubescence. 15.
Longitudinal stripes of mesothorax not joining marginal band 18.
15. Smaller; tegulae clear red 16.
Larger; tegulae dusky red to piceous 17.
16. Lower part of pleura not covered with hair; axillae red at end.
T. rhododontus Cockerell.
Lower part of pleura covered with hair; axillae short and black.
T. schwarzi Cockerell.
17. Lateral angles of black on second abdominal segment right angles; apical plate narrower *T. dichropus* Cockerell, ♂.
Lateral angles of black on second abdominal segment acute; apical plate broader *T. fortis*, Cockerell, ♂.
Much smaller than *fortis*, with shorter axillae and longer fourth antennal joint, and whole mesopleura densely covered with hair . . *T. sequior* Cockerell, ♂.
18. Axillae red *E. pusillus* Cresson.
Axillae black; scape black 19.

forming an acute inner angle with band; apical plate narrow; second and third ventral segments with very broad hair-bands which in some lights appear silvery-white (not at all ochreous), that on second strongly emarginate, almost divided, in middle posteriorly.

Related to *E. hitei* Cockerell, but much less robust, and with black legs and antennæ.

***Epeolus lutzi*, new species**

COLORADO: 3 ♂, Walsenburg (type locality), about 6200 ft. alt., Sabina-pinyon country, June 14, 1919; 1 ♂, Regnier, along the state border south of Lamar, about 4400 ft. alt., pasture land, June 7, 1919. UTAH: 1 ♂, Salt Lake City, about 5000 ft. alt., near Fort Douglas, July 28, 1920.

♂. (Type) Length 6.5–7.5 mm.; black, with pale ochreous markings, the dense hair covering face pure silvery white; tegulæ apricot-color; mandibles broadly bright chestnut-red in middle; antennæ black, third joint obscurely rufous apically; legs bright ferruginous, with appressed white hair, but anterior femora black except apically, and anterior tibiæ broadly black in middle; eyes pale green, orbits strongly converging below; labrum black, reddish apically; mesothorax densely punctured, thinly covered with pale ochreous hair, which is denser along the margins, and shows anteriorly two nebulous broad converging bands, not reaching the center; scutellum moderately bigibbous, axillæ pointed; pleura covered with light hair; wings hyaline, dusky apically, stigma dark red; nervures fuscous, red basally; spurs clear red; abdomen with broad entire bands, but those on first two segments strongly emarginate anteriorly, their anterior margin on each side of the incision convex; black area on first segment a transverse band, very obliquely truncate at each side; band on second segment with large round lateral lobes, making an acute angle with the band; anterior (basal) margin of bands on third and fourth segments strongly undulate; apical plate very broad, bright red; venter broadly covered with pure white hair in middle, and also on hind margins of first three segments, leaving large black sublateral subquadrate areas.

♂. Similar, but differing thus: eyes dark purplish, green above; third antennal joint wholly black; mesothorax with the area not covered by the broad converging (basad) longitudinal bands and marginal pubescence black, not covered with pale hair, there is a black triangular area anteriorly, between the bands; fifth segment abdomen with the usual broad silvery lunule.

***Epeolus lutzi dimissus*, new race**

COLORADO: 1 ♀, Leadville, about 10,200 ft. alt., in a vacant lot in town, August 4, 1919.

Smaller, length 6 mm.; middle femora black, with the apex broadly red; hind femora somewhat dusky; bands on mesothorax shorter and less distinct; tegulæ smaller, shining; hair of abdomen whiter, the black area on first segment less sharply defined.

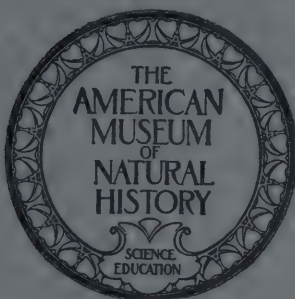
A race of high altitudes. *E. lutzi* is less coarsely punctured than *E. hitei* Cockerell, and differs in the color of the antennæ and other characters. It is larger than *E. humillimus* Cockerell, which has interrupted abdominal bands, and widely separated stripes on mesothorax.

AMERICAN MUSEUM NOVITATES

No. 24

WESTERN BEES OBTAINED BY THE AMERICAN MUSEUM EXPEDITIONS

By T. D. A. COCKERELL



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WESTERN BEES OBTAINED BY THE AMERICAN MUSEUM EXPEDITIONS

By T. D. A. COCKERELL

This is the third report¹ upon the bees obtained in the course of the American Museum's entomological survey of the Western States. It includes parasitic bees and Panurgidæ. Unless otherwise stated, the specimens were collected by Frank E. Lutz and the field notes are by him.

NOMADA Scopoli

Nomada crucis Cockerell

UTAH: 1 ♀, 2 ♂, Salt Lake City, about 5000 ft. alt., near Fort Douglas, July 28, 1920, collected by Mrs. F. E. Lutz. COLORADO: 1 ♀, Grand Junction, about 4500 ft. alt., in a vacant lot near the Fair Ground, August 3, 1920.

Described from the Mesilla Valley of New Mexico, and considered a Middle Sonoran species. The specimens from Utah and Colorado are quite typical. Swenk records it from Arizona. In Texas it intergrades with *N. texana* Cresson.

Nomada vineta Say

COLORADO: 5 ♀, 7 ♂, Wray, about 3700 ft. alt., both sexes at *Helianthus*, one male taken by evening sweeping in a relatively moist place along the river, some collected by Pearce Bailey, Jr., August 17, 1919; 1 ♀, Boulder, about 5500 ft. alt., in a vacant lot in town, August 8, 1919.

Common in Eastern Colorado, but I did not take it in New Mexico.

Nomada vineta heterochroa, new variety

COLORADO: 2 ♂, Wray, about 3700 ft. alt., one taken with the typical form in evening sweeping and one in a moist place at the head of Dry Willow Creek, August 17 and 18, 1919.

Mesothorax red, with a large cuneiform black mark, having its base on posterior margin; mesopleura red, except for the yellow patch; base of abdomen and bands red instead of black, sometimes with black at bases of second and third segments.

A color-variety, not a race, but very distinct in appearance.

¹For the preceding reports see American Museum Novitates, No. 21, December 1, 1921, and No. 23, December 5, 1921.

***Nomada zebrata* Cresson**

COLORADO: 1 ♂, 1 ♀, Wray, about 3700 ft. alt., in more xerophytic places than were *vincta*, the female at *Helianthus*, August 18, 1919; 1 ♀, Boulder, about 5500 ft. alt., in town, August 8, 1919.

Extends southward to the White Mountains of New Mexico.

***Nomada gutierreziae* Cockerell**

COLORADO: 1 ♀, Pueblo, in a vacant lot in town, August 9, 1920.

Previously known from the Mesilla Valley, New Mexico. The anterior coxæ have very short but distinct spines.

***Nomada morrisoni* Cresson**

COLORADO: 2 ♀, South Fork, about 8200 ft. alt., near the junction of the two headwaters of the Rio Grande, June 17, 1919.

One differs from the type in having the spots on metathorax entirely red and yellow band on first abdominal segment broadly interrupted. The other has the spots on metathorax yellow.

***Nomada civilis* Cresson**

IDAHO: 1 ♂, Montpelier, about 6100 ft. alt., near town, July 6, 1920.

There are two large yellow spots on scutellum, but in some examples of *N. civilis* (for example, from Florissant, Colorado) these are absent.

***Nomada cymbalariae* Cockerell**

COLORADO: 1 ♂, Mineral County, about 37° 27' N., 106° 54' W., near the junction of Wolf and Fall Creeks, about 7900 ft. alt., vegetation of oak, Engelmann spruce, etc., June 20, 1919.

This falls with the male which I have, without having definite proof, regarded as belonging to *cymbalariae*. It differs from a Florissant specimen in lacking the upper (somewhat enlarged) ends of lateral face-marks, in not having distinctly red hair on scutellum, in the smaller and entirely yellow scutellar spots, and in the more obscure band on first abdominal segment. These differences might all fall within the limits of variation.

***Nomada edwardsii* Cresson**

IDAHO: 1 ♀, Victor, about 6300 ft. alt., vegetation of aspens, roses, etc., July 11, 1920.

This is a member of the Pacific Coast fauna, extending inland to Idaho. The same is true of the next species, *N. citrina*. The Californian *N. coquilletti* Cockerell also reaches Idaho.

Nomada citrina Cresson

IDAHO: 1 ♀, Bear Lake, about 6200 ft. alt., along Fish Haven Creek, July 9, 1920.

In my table in 1903, Proc. Acad. Nat. Sci. Phila., LV, p. 582, this runs to *citrina* var., based on a specimen from Grangeville, Idaho.

Nomada pecosensis (Cockerell)

COLORADO: 2 ♀, Pagosa Springs, about 7700 ft. alt., in the U. S. forest reservation, June 21, 1919.

A little larger than the type. Previously known from Pecos, New Mexico, and Palisades, Colorado, taken in May and June.

Nomada accepta Cresson

COLORADO: 1 ♀, Aspen, about 8300 ft. alt., along Castle Creek, July 15, 1919, collected by Herbert F. Schwarz.

Nomada alpha Cockerell

This species differs from *morrisoni* in the red legs (with hardly any yellow), narrower face, and other characters (see Swenk, Univ. of Nebraska Studies, XII, p. 73), but both are very variable and I now incline to the opinion that they represent diverse forms of a single species. The matter will only be settled when we have larger series, including males. Typical *alpha* is from Fort Collins, Colorado, 4980 ft. alt.

Further confusion is introduced by the discovery of two additional forms of *alpha*, as follows.

Nomada alpha paralpha, new variety

COLORADO: 1 ♀, Walden, about 8400 ft. alt., among sagebrush on hillside, June 17, 1920.

♀.—Differs thus: length fully 10 mm.; mandibles not yellow basally; labrum yellowish, but clypeus and other face-markings pale red; red lateral face-marks continuous with stripes along posterior orbits, and with a swelling or lobe opposite the frontal spot; yellow behind eyes indistinct; scape red, with a black stripe behind; third antennal joint hardly longer than fourth; mesothorax with a very broad median black stripe, and narrower lateral ones, inclined to be slightly interrupted in middle, or one may say, black with four red stripes, the outer marginal; middle of pleura red, and a red spot beneath the wings; scutellum entirely red; anterior femora with a large black mark behind; first abdominal segment largely black at base; venter light red.

Nomada alpha dialpha, new variety

COLORADO: 2 ♀, Walden, about 8300 ft. alt. on the more mesophytic river-bottom among willows, cottonwood, Iris, etc., June 17, 1920.

♀.—Length, 9.3–10.3 mm.; similar to *paralpha*, the venter red, or with an obscure yellow band on fourth segment, but mesothorax red with a black triangle on

anterior margin. There is more red on front, the larger specimen having a broad red band right across. Red band behind eyes broader, without any yellow. Scape entirely red. Mesopleura almost entirely red, contrasting with the yellow tubercles. Anterior femora without black. First abdominal segment red, without black base or yellow spots.

These forms have some resemblance to *N. collinsiana* Cockerell, but are quite distinct.

***Nomada calloxantha*, new species**

WYOMING: 1 ♀, Stewart Ranger Station, in the Jackson Hole country at about 43° 42' N., 110° 45' W., about 6700 ft. alt., lodgepole pine, Engelmann spruce, etc., July 18, 1920.

♀.—Length about 12 mm.; bright sulphur yellow, marked with red and black; head broad, orbits somewhat converging below; eyes pale grayish, suffused with reddish, but on the upper third greenish; hair of head and thorax scanty, dorsum of thorax almost entirely nude; mandibles simple, yellow, black at end; lateral face-marks broad, extending over eyes to a broad stripe down posterior orbits, but interrupted by a large red patch on upper part of front; black marginal spots on clypeus, connected by a line with base of antennæ; region above and between antennæ blackened, but a transverse red band across front; vertex and posterior part of head black, a little red on occiput; antennæ stout; scape thick, yellow, partly red behind; flagellum entirely bright ferruginous; third antennal joint about as long as fifth, but conspicuously shorter than fourth; mesothorax coarsely rugose and dull, red, with yellow stripes over tegulæ and behind, and a median black band, narrow and faint in middle, triangularly expanded posteriorly, and less so in front; prothorax black, with the swollen upper margin and tubercles yellow; a small black area below wings; mesopleura yellow, with a transverse reddish stain on upper part, and a large red patch below; a broad black area behind mesopleura, bordered with red at sides of metathorax; metathorax with a broad median black band, the sides of the basal area having large yellow patches; scutellum and postscutellum yellow, the former strongly bigibbous; tegulæ pale yellowish, semitransparent; wings reddish, stigma and nervures ferruginous; basal nervure going a considerable distance basad of transverse median; third submarginal cell broad below; legs yellow; anterior trochanters and marks at base of femora red; middle coxæ mainly black, their trochanters red with a yellow spot, and their femora largely red at base; hind coxæ marked with red and black, their trochanters red, their femora mainly black on inner side, and with a red basal patch above, their tibiæ red on inner side except at base, their basitarsi with dense short light red hair on inner face; abdomen bright yellow; basal half of first segment red, with a median black mark; four rather narrow dark bands, the first two reddish, on apices of segments and adjoining bases; venter yellow, with two narrow dark bands, failing laterally.

A member of the subgenus *Xanthidium*, running in my tables to *N. morrisoni flagellaris* Cockerell, but certainly distinct. In Swenk's table of Nebraska species it runs to the much smaller *N. citrina flavo-marginata* Swenk, and in his further table of the same group (Univ. of Nebraska Studies, XII, p. 68) it runs nearest to *N. rufula* (Cockerell),

which was described as a variety of *citrina*. It differs from *rufula* in the venation and other characters and is, I think, certainly distinct. *N. rufula* is from Idaho.

***Nomada melanoptera*, new species**

COLORADO: 1 ♀, Wray, about 3700 ft. alt., on a dry hill near town, July 17, 1919.

♀.—Length about 11 mm., broad and robust; head black and red, thorax and abdomen black and bright lemon-yellow; mandibles simple; anterior coxæ without spines; third antennal joint long, much longer than fourth or fifth, but not as long as the two together; basal nervure meeting transverse median; abdomen strongly punctured. Head broad, facial quadrangle broader than long; eyes pale red; mandibles (except apex), labrum, lower margin and broader corners of clypeus, and entire sides of face ending obliquely a little above antennæ, bright ferruginous; face and front very coarsely punctured, clypeus with a smooth area on lower middle, supraclypeal area with very large sparse punctures; posterior orbits with a narrow red stripe, flushed with yellow at its upper end; antennæ with the first three joints bright red, the next three reddish, the rest black; mesothorax entirely black, very coarsely and densely punctured; prothorax black, with the thick upper border and the tubercles yellow; pleura very coarsely punctured, entirely black; metathorax all black; scutellum bigibbous, with two very large round yellow spots; postscutellum yellow; tegulæ bright red; wings dark fuliginous, with an irregular hyaline area in the subapical region, but the apical very dark; stigma ferruginous, nervures fuscous; legs bright red; hind tibiæ with a pointed posterior apical lobe, on the outer margin of which are four equal spines; abdomen broad, black, the first five segments with broad yellow bands, that on second very broad, that on fifth broadly emarginate posteriorly; sides of apex with dark fuscous hair; venter black, with a red transverse line on first segment, not extending to sides.

A remarkable species, which persistently falls with *N. (Holonomada) superba* Cresson in the tables, but is actually very different and closely related to *N. (Micronomada) arenicola* Swenk, but without coxal spines, or yellow on face or pleura. The hind tibiæ are very distinctive.

***Nomada crawfordi lachrymosa*, new variety**

WYOMING: 1 ♀ (type): Jackson, about 6300 ft. alt., along Cache Creek, among vegetation of moderately moist pasture-land type, July 15, 1920; 1 ♀, Rawlins, about 6800 ft. alt., among sagebrush on a hill near town, June 23, 1920; 1 ♀, Medicine Bow, about 6600 ft. alt., among sagebrush on the ridges having a few *Pinus scopulorum*, June 23, 1920.

♀.—Length about 11 mm.; general color of head, thorax and legs bright ferruginous, of abdomen bright yellow; eyes pale reddish gray; mandibles simple, black at end; labrum yellow; lower border of clypeus and sides of face suffusedly yellow; face broad; cheeks with pale red hair; front red; antennæ entirely bright ferruginous or darkened apically, third joint long, but shorter than fourth; mesothorax dull and densely punctured, dull red, with a black mark posteriorly; tubercles and upper border of prothorax yellow; pleura red, with a small yellow mark, not always present;

scutellum strongly bigibbous, it and the postscutellum red; metathorax with a pair of dull pale yellow spots, and often a black shade in center of basal area; tegulae orange, with a yellow spot; wings reddish, stigma bright ferruginous, nervures fuscous; basal nervure going a little basad of transverse median; anterior tibiae faintly suffused with yellow at base; hind femora with a broad black area behind; hind tibiae with an apical outwardly projecting emarginate lobe; hind basitarsi with shining golden hair on inner side; abdomen yellow with four narrow red bands, first segment red at base; venter yellow with bases of segments red, and first segment all red; second segment broadly emarginate posteriorly.

A *Xanthidium*, running in the tables near to *zebrata* and *rufula*, but quite distinct. It closely resembles *N. crawfordi* Cockerell, differing by the broad continuous yellow band on first abdominal segment, whereby it resembles *N. rhodoxantha* Cockerell. The proportions of the antennal joints are as in *crawfordi*, and after close comparisons I must regard it as a race or variety of that species, rather than an independent species. Swenk refers to a form of *crawfordi* from Nebraska, with a complete yellow band on first abdominal segment. Swenk suggests that the males which I described as *N. gillettei* and *N. ednae* represent variations of *crawfordi*. I have no *gillettei* but, on comparing the type of *ednae*, it seems to me to be specifically distinct, though very closely allied.

The name of this variety is in allusion to the tear-like yellowish suffusion on anterior orbits.

***Nomada concinnula*, new species**

COLORADO: 2 ♀, Electra Lake (type locality), near Durango, about 8400 ft. alt., June 29, 1919; 2 ♀, Pagosa Springs, about 7400 ft. alt., in U. S. forest reservation, San Juan valley, June 23, 1919. Both of these regions contained oaks, *Pinus scopulorum*, etc.

♀.—Length about 9 mm.; head, thorax and legs clear red, almost without yellow; sides of face suffusedly lemon-yellow; tubercles and postscutellum inclining toward orange; mandibles simple, black at end; eyes pale reddish; clypeus closely and finely punctured; antennae long, bright ferruginous, third joint considerably shorter than fourth, but more than half as long; mesothorax finely granular, entirely red; scutellum strongly bigibbous; lower part of pleura deeper, less yellowish, red than the rest; a little black about bases of coxae, and hind femora variably suffusedly blackened on inner side; tegulae yellowish red, shining but punctured; wings reddened, stigma dull ferruginous, nervures fuscous; basal nervure going a little basad of transverse median; abdomen light red with bright yellow bands, on first segment broken into two spots, on second broad at sides but thin and flexuous in middle, varying to much broader; on third, fourth and fifth broad, the last with a pair of pellucid spots; venter with first segment red, the next three with broad yellow bands the fifth with a pair of large round yellow spots, containing a small reddish spot near margin.

A pretty little *Xanthidium*, perhaps related to *rufula*. Superficially it looks exactly like *N. vallesina* Cockerell; but that has the fourth antennal joint much shorter, lacks the yellow at sides of face, etc.

***Nomada carinicauda*, new species**

COLORADO: 1 ♀, along the South Fork of the Rio Grande at about 37° 36' N., 106° 43' W., about 5800 ft. alt., among *Pinus scopulorum*, *Pseudotsuga mucronata*, *Picea pungens*, etc., June 17, 1919.

♀.—Length about 9 mm., red, similar to *N. depressicauda* Cockerell (to which it runs in the table in Entom. News, 1908, p. 323), but with the flattened caudal area much larger (describing about half a circle), with a minutely granular or tessellate bare surface, and three longitudinal keels, the keels and the margin briefly and microscopically pubescent. It also differs by the darker red of head and thorax; the longer third antennal joint (still, however, not quite so long as fourth); scutellum more strongly bigibbous. The only yellow markings on abdomen are large spots on second segment, and very small ones on third.

***Nomada vicinalis* Cresson, variety *infrarubens* Cockerell**

COLORADO: 1 ♂, Telluride, about 10,000 ft. alt., along Cornet Creek trail, July 9, 1919; 1 ♂, South Fork of Rio Grande between Pass and Hope Creeks, about 9300 ft. alt., June 18, 1919; 1 ♂, Electra Lake near Durango, about 8400 ft. alt., June 29, 1919. All of these localities are in forest regions.

These agree with Cresson's description, except that the venter is without yellow, except a suffused spot near apex. The mesothorax appears wholly black, but in the Rio Grande and Telluride specimens it is possible to see a pair of very faint red lines. The scutellum has two red spots, but no yellow. The variety *infrarubens* was described from Oregon, but the Colorado specimens cannot be separated. On the other hand, I find that *N. vicinalis aldrichi* Cockerell, from Idaho, is distinct. Compared with *aldrichi*, the present insect differs by the shorter third antennal joint and the deep emargination of the black mark on first ventral segment. I think the Idaho insect must stand as *N. aldrichi*, a separate species. It is a comparatively large form.

***Nomada illinoënsis* Robertson**

COLORADO: 1 ♀, Camp Creek Ranger Station in the Medicine Bow Range about 41° N., 106° 12' W., about 8700 ft. alt., lodgepole pine and sagebrush, June 19, 1920.

This is referred to *illinoënsis* because it appears to agree with the Nebraska form so referred by Swenk, though it has the third antennal joint considerably longer than in what I had considered to be *illinoënsis*, from Oklahoma. It appears legitimate, for the present, to interpret *illinoënsis* in a rather broad sense, recognizing that when the sexes, habits, and genitalia are known, in all probability several valid species will be segregated.

Nomada (Gnathias) orophila, new species

COLORADO: 2 ♂, 1 ♀, Camp Creek Ranger Station in the Medicine Bow Range about 41° N., 106° 12' W., about 8700 ft. alt., lodgepole pine and sagebrush, June 19, 1920.

♂ (Type).—Length about 8 mm.; head and thorax black, with coarse long white hair, slightly yellowish dorsally; face broad, orbits converging below; eyes gray; mandibles bidentate, bright yellow with dark apex; labrum, clypeus (except upper border), mark beneath eyes, and narrow lateral face-marks (ending on orbits about level of antennæ) all bright yellow; scape yellow in front; flagellum bright red, the first few joints blackened above; third antennal joint almost as long as fourth; upper border of prothorax obscurely marked with yellowish; tubercles yellow, anteriorly reddish; scutellum red, flattened, not bigibbous, densely covered with long hair; pleura with a yellow mark, bordered with reddish, in front; tegulae shining ferruginous; wings brownish, stigma ferruginous, nervures fuscous; basal nervure going far basad of transverse median; legs red, anterior knees yellowish, hind femora black behind and beneath, except at apex; abdomen bright red, with narrow black bands, which are in the main on the extreme bases of the segments; very large spots on second segment, smaller ones on third, but no other yellow markings; first dorsal segment black basally, and first ventral black in middle.

♀.—Length about 8 mm.; head and thorax rather dusky red, abdomen bright chestnut red, polished; hair of top of head and scutellum strongly reddish; face red with no yellowish tint; middle of front and region of ocelli black, and a black band passes downward from each antenna, invading sides of clypeus; eyes gray; antennæ entirely bright red, third joint perhaps a little longer than fourth; mesothorax red with a broad median black band, and narrow lateral ones, failing posteriorly; meta-thorax red at sides of middle but broadly black in middle and extreme sides; cheeks black with a red postorbital band; legs bright red, the femora with a black spot at base beneath; abdomen with spots on second segment round and rather small, on third nearly obsolete; first ventral with a large bifid black mark, the lobes of which are very broad and obtuse.

In *Gnathias*, the Rocky Mountain males usually differ from those of the Eastern and Northwestern States in the more or less red mesothorax; but *N. orophila*, from high in the mountains, has it black. The male *orophila* falls near *N. cuneata* Robertson, but is much more robust in every way. The female also falls next to *cuneata*, but has less yellow on the abdomen.

Nomada bella Cresson

IDAHO: 1 ♀, Victor, about 6300 ft. alt., July 11, 1920; 1 ♀, Giveout, near Montpelier, about 6700 ft. alt., July 7, 1920. COLORADO: 1 ♀ (a variation with basal area of metathorax black), along the South Fork of the Rio Grande at about 37° 36' N., 106° 43' W., about 8500 ft. alt.

Specimens from Costilla County, Colorado, which Swenk in 1912 placed under *bella*, were transferred by him to *schwarzi* in 1915. The type of *schwarzi* is a male from Veta Pass. The female described by me

under *schwarzi* was *lepida*. At present, I probably have the ♀ of *schwarzi* mixed with Rocky Mountain *bella* and do not know how to separate it.

***Nomada carolinæ* Cockerell**

COLORADO: 2 ♀, Julesburg, at *Salix* flowers along the river, about 3460 ft. alt., June 7, 1920.

Compared with a Nebraska specimen, one of these differs by lacking the black band down middle of metathorax, and the somewhat longer third antennal joint. On comparing specimens from Virginia and Texas, I find enough variation to include the Julesburg insect, unless *carolinæ* as at present accepted should prove capable of subdivision. The other specimen with exactly the same data has the metathoracic band well developed, and in general agrees well with the Nebraska specimen.

***Nomada perplexa* Cresson**

WYOMING: 1 ♀, Jackson, about 6300 ft. alt., among vegetation of moderately moist pasture-land type, July 14, 1920.

The form without yellow spots on abdomen. *N. perplexa* is common in the Northern Atlantic States (Pennsylvania, for example), but I did not expect to see it from Wyoming.

***Nomada siouxensis* Swenk**

WYOMING: 1 ♀, Jackson, about 6600 ft. alt., among blue spruce, aspen, and other mesophytic plants along Cache Creek, July 15, 1920.

Differs from the original description in having small and inconspicuous orange spots at sides of second abdominal segment, but evidently this species. It was described from Sioux County, Nebraska.

***Nomada* (*Gnathias*) *heterosticta*, new species**

IDAHO: 1 ♀, Victor, about 6300 ft. alt., among aspens, roses, etc., on the hills across the river from the town, July 11, 1920.

♀.—Length about or nearly 10 mm.; bright ferruginous red, not dark; mandibles bidentate, black at end; a dusky shade between antennæ, region between (but not around) ocelli blackened, and cheeks black behind, leaving a red band as broad as the black; eyes pale red; antennæ entirely clear ferruginous, third joint about as long as fourth; mesothorax with a narrow median black band; femora without black, except that the hind femora have a dusky stripe beneath, not conspicuous; tegulæ dull pale reddish, strongly punctured; wings dilute reddish fuliginous, stigma ferruginous, nervures dark fuscous; basal nervure going far basad of transverse median, third submarginal cell unusually broad above; abdomen clear red, without black marks at base above or below; sides of second segment with small yellow spots, but on third, in place of yellow marks, are dusky dots.

In my table this runs nearest to *N. grayi* Cockerell, but it differs in a number of characters and is especially recognizable by the markings of the abdomen.

***Nomada* (*Gnathias*) *clarescens*, new species**

COLORADO: 1 ♀, Walden, about 8300 ft., on the sagebrush hills near town, June 17, 1920.

♀.—Length nearly 10 mm.; clear red, the antennæ entirely red, the flagellum with a fine pruinose pubescence; eyes red; mandibles bidentate, black at end; a blackish W-like mark about bases of antennæ, and the region between ocelli blackened; cheeks black behind, leaving a very broad red band; third antennal joint about as long as fourth; mesothorax with a narrow black band; middle of metathorax with an elongate black spot; pleura with abundant long pale hair (short scanty hair in *N. heterosticta*); scutellum strongly bigibbous (so also in *heterosticta*); tegulæ ferruginous, rather shining; wings dusky with the usual hyaline space; stigma dusky reddish (smaller and narrower than in *heterosticta*); basal nervure going far basad of transverse median, third submarginal cell greatly narrowed above; femora marked with black beneath at base; inner face of hind basitarsi with very pale hair; first abdominal segment with a round black spot on each side near base; second with small yellow spots, the rest without yellow; first ventral with a blackish shade, but no well-defined mark.

The first ventral segment and other characters readily distinguish it from *N. grayi*.

***Nomada* (*Gnathias*) *vulpis*, new species**

WYOMING: 1 ♀, Foxpark, about 9100 ft. alt., in the Medicine Bow Range, lodgepole pine, and sagebrush, June 15, 1920 (snow still lying in patches nearby).

♀.—Length nearly 10 mm.; red, with the aspect of *N. clarescens*, but a little less robust. It is certainly distinct, by the following characters: black about antennæ and ocelli much more extensive, and continuing as sutural lines half-way down sides of clypeus; flagellum more slender, and dusky above, toward base strongly blackened; median band of mesothorax broader, and a broad median black band down middle of metathorax, including basal area; extreme sides of metathorax broadly black; red band along posterior orbits much narrower; second submarginal cell not so broad, receiving first recurrent nervure about beginning of last third; second abdominal segment with large clear-cut yellow marks; third wholly without spots; first ventral with a black fish-tail mark.

Allied to *N. bella*, but I think certainly not a variety of it. Compared with a specimen of *N. maculata* Cresson (♀ of *bella*) from Franklinville, Pa., it is considerably less robust, with smaller head, much more black on face, cheeks mainly black (in the *maculata* red, with a black patch posteriorly, covered with hair and inconspicuous), yellow on abdomen reduced to a pair of spots, surface of abdomen less shining, etc. It evidently approaches Swenk's interpretation of female *N. schwarzi* Cockerell, but the probabilities are against its reference to that species.

11. Lateral face-marks following anterior orbits (which are parallel) to top of eyes; scape swollen.....*zebrata* Cresson, ♂.
Lateral face-marks not following orbits to top of eyes.....12.
12. Larger; face broader; orbits conspicuously diverging above; lateral face-marks not curved mesad at upper end.....*edwardsii* Cresson, ♀.
Smaller; face not so broad; orbits nearly parallel; lateral face-marks curved mesad at upper end.....*citrina* Cresson, ♀.
13. Area of metathorax with a short yellow band on each side; third antennal joint long.....*pecosensis* Cockerell, ♀.
Area of metathorax all black.....*vincta* Say, ♂.
14. Mesothorax black (often with a pair of very narrow and obscure red lines in *vicinalis infrarubens*); scutellum red or marked with red.....15.
Mesothorax red, or red and black.....17.
15. Lateral face-marks curving away from orbit at top; mandibles simple.
vicinalis infrarubens Cockerell, ♂.
Lateral face-marks not curving away from orbit.....16.
16. Mandibles simple; basal nervure going very little basad of transverse median.
illinoënsis Robertson, ♂.
Mandibles bidentate; basal nervure going far basad of transverse median.
orophila Cockerell, ♂.
17. Abdomen with cream-colored bands, continuous on fourth and fifth segments; clypeus red.....*accepta* Cresson, ♀.
Abdomen with continuous lemon-colored bands, at least on one of the first three segments.....18.
Abdomen without such bands; clypeus not yellow.....21.
18. First abdominal segment with a broad continuous yellow band.
crawfordi lachrymosa Cockerell.
First abdominal segment without such a band.....19.
19. Mesothorax black with four red bands; front black except sides broadly, and a spot below middle ocellus; tubercles and postscutellum yellow.
alpha paralpha Cockerell, ♀.
Mesothorax red.....20.
20. Larger; region of ocelli broadly black.....*alpha dialpha* Cockerell, ♀.
Smaller; region of ocelli red, with at most a little black.
concinnulla Cockerell, ♀.
21. A transverse black patch above or between antennæ.....22.
No black patch above or between antennæ; mandibles bidentate.
carolinæ Cockerell.
22. Abdomen with narrow black bands; mandibles simple.
packardiella Cockerell, ♀.
Abdomen without distinct black bands, or only on one or two segments...23.
23. A small black spot at each side of third segment near base; no black spots on fourth segment; mandibles bidentate.....*heterosticta* Cockerell, ♀.
No such black spots on third segment.....24.
24. Abdomen with a large highly modified caudal area, with three keels.
carinicauda Cockerell, ♀.
Abdomen without such an area; mandibles bidentate.....25.

Calliopsis coloradensis fedorensis (Cockerell)

The female has the disc of first abdominal segment beset with fine punctures, but I cannot find good characters for the male. One female (Boulder, COLORADO, on the plains at about 5300 ft. alt., August 12, 1919) had the clypeus black except the lower corners and a T-shaped mark. It is only a variant, as three typical *fedorensis* females were taken at Boulder, with the same data. One female from Salt Lake City, UTAH, at about 5000 ft. alt., July 28, 1920, collected by Mrs. F. E. Lutz, can be referred here, but the punctures on the first segment are much coarser, and it is presumably an independent mutation from *coloradensis*.

Professor O. A. Stevens has taken *fedorensis* at flowers of *Grindelia squarrosa*, at Fargo, North Dakota. He obtained, with normal females, a variant in which the clypeus is entirely black, except a slender line across its upper border.

Calliopsis chlorops Cockerell, 1899, is not to be separated from *coloradensis*. The male differs from Cresson's description in having the tibiae brown or piceous posteriorly, but this is not even a good racial character.

C. coloratipes (Cockerell) is at least a good subspecies; the male has the face creamy white or very pale yellowish, instead of lemon-yellow, and the female lacks the black bars on clypeus. *C. coloratipes* occurs in New Mexico and Arizona, in the Middle and Lower Sonoran Zones.

Calliopsis rhodophilus (Cockerell)

This is the western representative of *C. andreniformis* Smith. Two males from Ouray, about 8500 ft. alt., July 11, 1919, and three males from Pagosa Springs, about 7400 ft. alt., June 23, 1919, are typical. One female from Estes Park, August 13, 1919, collected by Herbert F. Schwarz, is a variation with face-marks reduced, the lateral marks reduced to small spots. It thus approaches *C. teucriti* Cockerell, which may be an extreme form of *rhodophilus*; but the mandibles are entirely dark, not bright ferruginous in middle as in *teucriti*. The abdominal venter lacks the light reddish bands seen in *teucriti*. The localities just mentioned are in COLORADO.

Calliopsis verbenæ nebrascensis Crawford

COLORADO: 1 ♂, Wray, about 3700 ft. alt., dry hills near town, August 17, 1919.

HYPOMACROTERA Cockerell and Porter**Hypomacrotera callops** Cockerell and Porter

COLORADO: 5 ♂, Regnier, near the state border south of Lamar, about 4400 ft. alt., at *Quincula lobata*, June 8, 1919.

PSEUDOPANURGUS Cockerell**Pseudopanurgus æthiops** (Cresson)

COLORADO: 8 ♀, 5 ♂, Wray, about 3700 ft. alt., some at *Helianthus*, August 18, 1919; 3 ♀, 10 ♂, La Junta, about 4100 ft. alt., August 12, 1920. UTAH: 5 ♀, 5 ♂, Ogden, August 29-30, 1916.

One male is stylipised, and differs from normal males in having the clypeus broadly black at sides, the supraclypeal yellow broader than high, the dog-ear marks much shorter, the lateral face-marks and yellow marks on scape wholly wanting. Also, the anterior and middle tibiae have the apical half black, and the sculpture of the abdomen is weaker. The stylipid is undescribed.

BOMBOMELECTA Patton**Bombomelecta fulvida** (Cresson)

COLORADO: 1 ♀, South Fork (near the headwaters of the Rio Grande), about 8200 ft. alt., near the town, June 17, 1919. ARIZONA: 1 ♀, Grand Canyon, May 24, 1918.

Bombomelecta pacifica (Cresson)

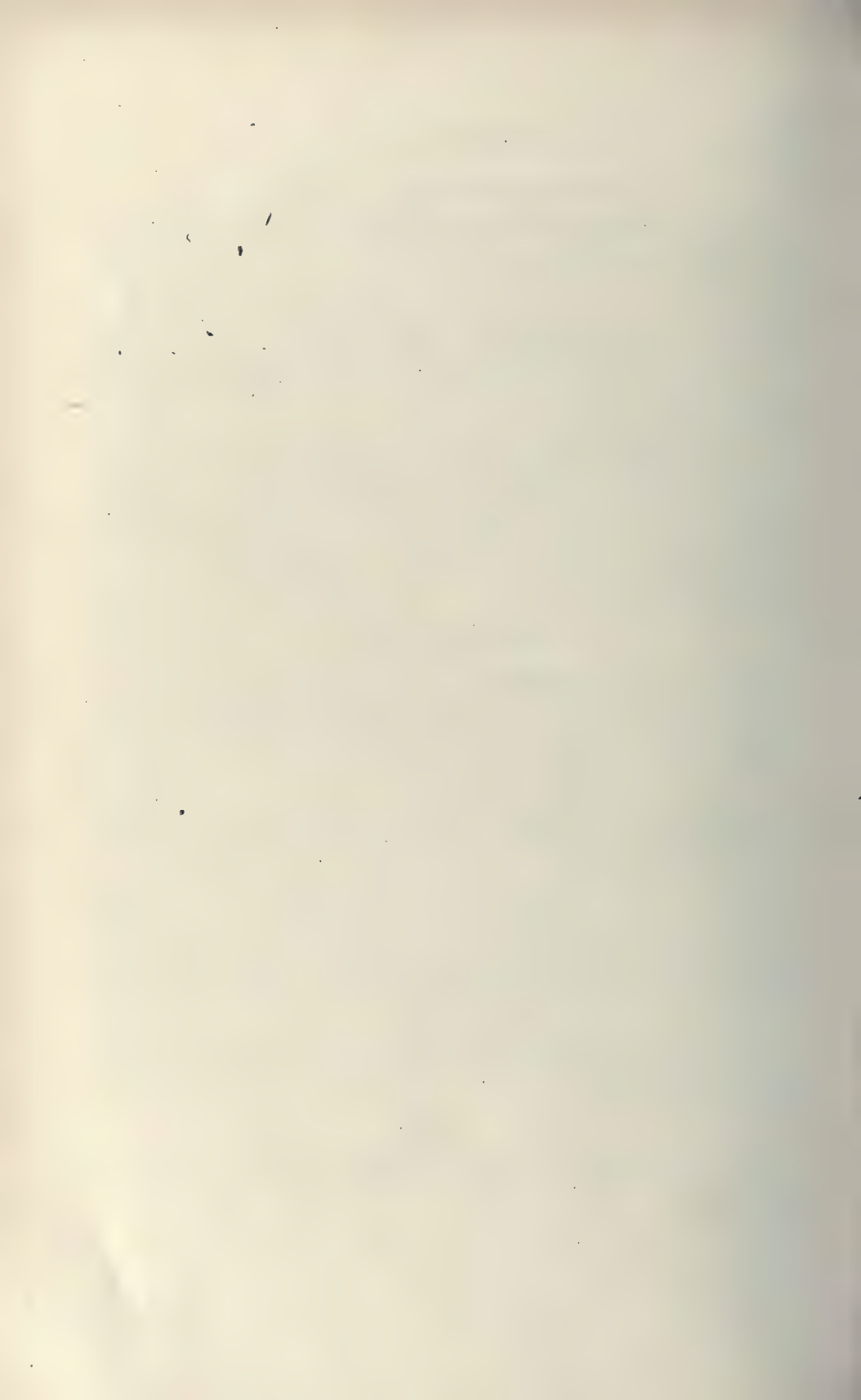
COLORADO: 1 ♂, Cheyenne Pass, near Laramie, about 8500 ft. alt., limber pine-Douglas fir country, June 13, 1920; 1 ♂, Julesburg, about 3460 ft. alt., near the river, at *Pentstemon radicosus*, June 7, 1920.

PSEUDOMELECTA Radoszkowski**Pseudomelecta rociadensis** (Cockerell)

COLORADO: 1 ♀, Gardner, September 1918, collected by Walter Granger (?); 1 ♀, Wray, about 3700 ft. alt., at head of Dry Willow Creek, August 18, 1919. Both specimens much worn.

Pseudomelecta miranda (Fox)

COLORADO: 1 ♂, La Junta, about 3100 ft. alt., along the roadside, August 12, 1920, collected by Mrs. F. E. Lutz.

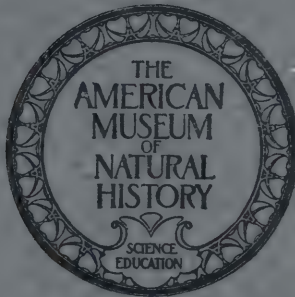


AMERICAN MUSEUM NOVITATES

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DESCRIPTIONS OF PROPOSED NEW BIRDS FROM CENTRAL AMERICA, WITH NOTES ON OTHER LITTLE-KNOWN FORMS

BY WALDRON DEWITT MILLER AND LUDLOW GRISCOM



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DESCRIPTIONS OF PROPOSED NEW BIRDS FROM CENTRAL AMERICA, WITH NOTES ON OTHER LITTLE-KNOWN FORMS

BY WALDRON DEWITT MILLER AND LUDLOW GRISCOM

As a result of studies made on the distribution of bird-life in Nicaragua, the authors here propose definite names for a number of birds, to invite criticism pending the appearance of their final report.

There is also included a discussion of the status of other little-known Central American birds, belonging to families that will be treated by Mr. Ridgway in the forthcoming part of his monumental work on the Birds of North and Middle America. We have to thank the authorities of the National Museum, and particularly Dr. Charles W. Richmond, for permission to examine material in their collection bearing on one of these cases.

Ortalis cinereiceps saturatus, new subspecies

SUBSPECIFIC CHARACTERS.—Similar to *Ortalis c. cinereiceps* but darker throughout and averaging smaller. Crown and nape very slightly darker, deep mouse-gray instead of deep neutral gray; the back, wing-coverts, and rump deep olive-brown, instead of medium olive-brown, the contrast greatest on the wing-coverts; primaries dark rufous rather than bright rufous, the dusky tips and centers of the feathers more extensive and noticeable; tail tips grayish buffy rather than gray with whitish margins, the tips of the three outer feathers averaging 2 mm. less in extent; breast darker olive-gray, shading into light buffy olive-gray on the belly instead of almost pure light gray, the contrast best seen on the thighs; under tail-coverts olive-brown, rather than grayish olive. In each series some specimens are much browner on the breast than others.

TYPE.—No. 101063, Amer. Mus. Nat. Hist.; ♂ ad.; near Matagalpa, Nicaragua; March 4, 1907; Wm. B. Richardson.

SPECIMENS EXAMINED

Ortalis cinereiceps saturatus.—NICARAGUA: Matagalpa, the type; Las Canas, Matagalpa, 1 ♂; Savala, 1 ♂; Muy Muy, 1 ♂; Rio Grande, 1 ♀; Chontales, 1 ♀; Los Sabalos, 1 ♂. COSTA RICA: Bonilla, 1 ♂; Aquinares, 2 ♂.

Ortalis cinereiceps cinereiceps.—PANAMA: Boqueron, Chiriqui, 1 ♂, 1 ♀; Canal Zone, 1 ♂, 1 ♀; Chepigana, East Panama, 1 ♂.

This form is based on 10 specimens from the humid tropical Atlantic forest region of Nicaragua and Costa Rica, and is compared with a series of what may be regarded as typical material from Panama. We have seen

no specimens from southern Costa Rica, but it would be surprising if the bird there did not approach the new form. There are slight differences in size, although the measurements of the two races show a considerable amount of individual variation.

MEASUREMENTS				
<i>O. c. cinereiceps</i>			<i>O. c. saturatus</i>	
Wing	3 ♂	196-216	8 ♂	187-204
	2 ♀	193	2 ♀	187-192
Tail	3 ♂	220-232	8 ♂	204-220
	2 ♀	219-222	2 ♀	197
Culmen	3 ♂	24-27	8 ♂	24-26
	2 ♀	23.5-25.5	2 ♀	22-23
Tarsus	3 ♂	65-68	8 ♂	65-67
	2 ♀	65-70	2 ♀	61-62

Creciscus ruberrimus, new species

SPECIFIC CHARACTERS.—Closely allied to *C. ruber* of Mexico and Guatemala, but differing in having the chestnut of the upper back extended over the entire upper-parts including the wing-coverts; the back, rump, upper tail-coverts, and wing-coverts rich deep chestnut instead of chocolate-brown; primaries and tail blackish instead of ashy brown; bill shorter and relatively stouter.

TYPE.—No. 143692, Amer. Mus. Nat. Hist.; ♀ ad.; Jinotega, Nicaragua (alt. about 3000 ft.); April 5, 1917; Miller and Griscom.

DESCRIPTION OF TYPE.—General color above rich deep chestnut, darkest on the rump; primaries and tail-feathers blackish, the secondaries deep blackish brown; crown, nape, and sides of face bright slaty gray, sharply demarcated from the chestnut color of the adjacent parts; throat and breast bright chestnut, becoming rich deep chestnut on the abdomen, belly, and under tail-coverts; thighs externally deep slaty gray, internally bright chestnut; under wing-coverts and axillars bright chestnut, the greater series ashy, edged with chestnut.

SPECIMENS EXAMINED

Creciscus ruberrimus.—NICARAGUA: Jinotega, the type.

Creciscus ruber.—MEXICO, 1; GUATEMALA, 1.

MEASUREMENTS			
	Nicaragua	Guatemala	Mexico
Wing	79	78	78.5
Tail	36	—	39
Culmen	18	21	21
Depth of Bill at Base	7.5	7.5	7.5
Tarsus	31	34.5	34
Middle Toe and Claw	37.5	39	40

This beautiful little Rail was collected in a surprisingly arid habitat, which is separated from that of *C. ruber*, its close ally, by a wide stretch of such mountainous and broken country that intergradation does not seem at all likely.

For the present we prefer to retain the old generic name, especially as Mr. Ridgway, the describer of *Thryocrex*, has not seen several important species. Until the exact limits of *Porzana* and *Creciscus* are determined by a critical examination of all the species involved throughout the world, there seems little point in proposing segregates from either. Our treatment must not, however, be taken as our opinion of the proper generic relationships of the two species here discussed, our material of this group of Rails being entirely inadequate.

***Gallinula chloropus centralis*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *G. c. cachinnans*, but decidedly darker and slightly smaller, the gray of the upper back and breast slightly darker, lower back much darker, "mummy brown," instead of "argus brown" or "Brussels brown," becoming blackish brown on the rump and upper tail-coverts.

TYPE.—No. 143693, Amer. Mus. Nat. Hist.; ad. ♀; 12 miles south of Metapa, Central Nicaragua; April 25, 1917; Ludlow Griscom.

SPECIMENS EXAMINED

Gallinula chloropus centralis.—NICARAGUA: Metapa, the type; Tipitapa, 1 ♀.

Gallinula chloropus cachinnans.—EASTERN UNITED STATES, 21 ♂, 20 ♀.

MEASUREMENTS

	Wing.	Culmen to	
		Hind Edge of Frontal Shield	Tarsus
Nicaragua 2 ♀	163.5-168 (165.7)	45-46 (45.5)	50-51 (50.5)
Eastern U. S. 20 ♀	164 -176 (170.2)	40-47 (44)	50-57 (54.1)

The two adult females listed above are so distinct from a large series of *cachinnans* that we have no hesitation in describing them. Birds seen at Los Sabalos by Nutting and specimens taken by Holland at Greytown probably belong to this race, but we are unable at this time to state its range more accurately. It is interesting to note that the proposed new race is not in any sense intermediate between *cachinnans* and *pauxilla* from western Colombia. The latter is by far the smallest, but is lighter on the back than even *cachinnans*. There seem to be but single records of the Florida Gallinule from Costa Rica and Panama. It would be interesting to determine accurately the specimens on which they are based.

We follow the latest authorities on the genus, Bangs and Hartert, in treating the American Gallinules as races of the Old World *chloropus*, but we are not convinced that this is the best course. While our material is not entirely satisfactory for a revision of the genus, we are strongly of the opinion that *sandvicensis* and *garmani* are distinct species, and that *cerceris* is a valid race.

***Asturina plagiata micrus*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *A. p. plagiata*, but much smaller, the adults averaging slightly darker, with narrower tail-bands, the immature birds noticeably darker.

TYPE.—No. 143746, Amer. Mus. Nat. Hist.; ad. ♂; 4 miles northeast of Chinandega, Nicaragua; June 12, 1917.

SPECIMENS EXAMINED

Asturina plagiata micrus.—NICARAGUA, adults, 4 ♂, 4 ♀; immature, 2 ♂, 1 ♀. COSTA RICA: Pigres, 1 ♀ ad.

Asturina plagiata plagiata.—ARIZONA, 1 ♂ ad.; TEXAS, 1 ♀ imm.; MEXICO, adults, 15 ♂, 10 ♀; immature, 13 ♂, 4 ♀.

MEASUREMENTS

	Wing	Tail	Culmen	Tarsus
<i>A. p. plagiata</i> 16 ♂	261–282 (269.4)	[190]–213 (202)	30–35 (31.9)	71–78 (74)
<i>A. p. micrus</i> 6 ♂	241–257 (250.5)	192–212 (201.2)	29–31 (30.3)	67–73 (69.8)
<i>A. p. plagiata</i> 10 ♀	287–300 (292.6)	[205]–233 (216.3)	33–35 (34.5)	74–88 (78.4)
<i>A. p. micrus</i> 5 ♀	256–282 (270.2)	180–214 (205.6)	30–34 (31.8)	69–79 (74.8)

The small size of this new form is its chief diagnostic character, even in a group of birds where there is so much individual variation, the wing measurements not even overlapping. The differences in color are slight, as the darkest birds of *A. p. plagiata* are indistinguishable from the lightest of *A. p. micrus*. The majority, however, of our specimens of the new form, both adult and immature, are darker than any in a very large series of the northern bird. The adults have the gray of a darker tone throughout, most noticeable in the cross-barring below. The immature have the upperparts and the tear-shaped spots beneath of a decidedly blackish brown. In typical adult *A. p. plagiata* from eastern Mexico there are usually two well-defined tail-bars, and in the majority of specimens traces of a third, while the middle bar is complete. In only one specimen is both the third tail-bar lacking and the middle one incomplete. Birds from Sinaloa and Sonora never have a trace of a third bar, the middle bar is complete in one specimen only, and in others is reduced to a mere spot.

We have two birds from Tepic, however, which show traces of a third bar, so that it is impossible to separate western and eastern Mexican birds subspecifically as we have found no other differences. The Nicaraguan bird is the extreme of the western Mexican tendency. The middle or second bar is always reduced to a spot, which in some specimens is scarcely discernible. In addition, the subterminal bar, which is always complete, averages narrower than in the northern bird.

We have seen no material in the territory between southern Mexico and Nicaragua, so cannot say where the boundary line between the two races is.

In Nicaragua this Hawk is a common bird of the Pacific slope and specimens exist from practically every locality where collecting has been done. There are no records for the Atlantic forest section. It is not at all shy, which probably accounts in part for the numerous specimens.

***Ictinia plumbea vagans*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar in color to *I. p. plumbea*, but averaging larger, the wing, ♂ 300–319; ♀ 292–316, the measurements of the two races not overlapping.

TYPE.—No. 103676, Amer. Mus. Nat. Hist.; ♂ ad.; Peña Blanca, Nicaragua; June 6, 1909; Wm. B. Richardson.

SPECIMENS EXAMINED

Ictinia plumbea vagans.—MEXICO, 1 ♀; GUATEMALA, 1 ♂, 1 ♀; HONDURAS, 1 ♂, 1 ♀; NICARAGUA, 4 ♂, 3 ♀; PANAMA, 1 ♂, 1 ♀; COLOMBIA, 1 ♀; ECUADOR, 5 ♂; PERU, 3 ♀; BRAZIL, Matto Grosso, 2 ♂, 6 ♀.

Ictinia plumbea plumbea.—COLOMBIA, 3 ♂, 1 ♀; ECUADOR, 1 ♀; TRINIDAD, 1 ♂; VENEZUELA, 1 ♀?; BRAZIL, Bahia, 1 ♀, Matto Grosso, 8 ♂, 2 ♀.

MEASUREMENTS

<i>Ictinia plumbea plumbea</i>								
		Wing	Tail	Tarsus		Wing	Tail	Tarsus
Colombia	♂ (Jan.)	270	148	40	♀ (March)	284	102	41
	♂ (March)	295	165	41.5				
	♂ (May)	279	146	40				
Ecuador					♀ (April)	274	150	42
Trinidad	♂ (March)	288	150	42.5				
Venezuela					♀ ? (late March)	267	146.5	41
Bahia					♀ (late March)	277	145	44.5
Matto Grosso	♂ (Aug.)	297	156	43.	♀ (Sept.)	285	161	42
	♂ (Sept.)	292	152	40	♀ (Oct.)	272	150	42
	♂ (Sept.)	293	153	41				
	♂ (Sept.)	278	152	41.6				
	♂ (Oct.)	286	145	40				
	♂ (Oct.)	291	149	41				
	♂ (Nov.)	288	153.5	40				
	♂ (Dec.)	288	162.	39.5				

<i>Ictinia plumbea vagans</i>								
Mexico					♀ (April?)	297	157	45
Guatemala	♂	311			♀	298		
Honduras	♂	313	161	42.5	♀	305	158.5	43
Nicaragua	♂	301	165	40	♀	296	158	44
	♂	307	—	40	♀	301	159.5	43
	♂	309	157.5	40	♀	311	167	41
	♂	311	159	42				
	♂ (?)	307	156	42	♀ (?)	306	162	42
Panama					♀ (June)	304	169	41
Colombia								
Ecuador	♂ (Oct.)	301	150	43.7				
	♂ (Dec.)	300	(150)	42				
	♂ (Dec.)	305	153	41				
	♂ (Dec.)	308	157.5	42				
	♂ (Jan.)	310	150	43.5				
Peru					♀ (Nov.)	311	168.5	38.5
					♀ (Nov.)	316	170.5	42
					♀ (Dec.)	299	169	40
					♀ (Sept.)	298	164	40.5
Matto Grosso	? (Aug.)	321	167	44	♀ (Oct.)	292	164	40.5
	♂ (Dec.)	307	159	41.5	♀ (Oct.)	292	161	37.5
					♀ (Nov. 30)	294	156	41
					♀ (Dec.)	296	164	41.5
					♀ (Jan.)	302	156	40.5

SUMMARY

		Wing	Tail	Tarsus
<i>I. p. plumbea</i>	12 ♂	270-297 (287.1)	145-165 (152.6)	39.5-43 (40.7)
<i>I. p. vagans</i>	14 ♂	300-321 (307.1)	150-167 (157.3)	40 -44 (41.9)
<i>I. p. plumbea</i>	6 ♀	267-285 (276.5)	145-162 (154.1)	41 -44.5 (42.1)
<i>I. p. vagans</i>	17 ♀	292-316 (301.1)	156-170.5 (162.7)	37.5-45. (41.3)

The recognition of this new race is apparently justified. In most of Central America it has been recorded only as a migrant in March, April, May, and November, but Salvin and Godman found it nest-building in Guatemala, and Richardson sent them birds from eastern Mexico in June and July. He has also sent us a bird from Peña Blanca, Nicaragua, taken in June, which may have been breeding. The species has never been recorded from Costa Rica. Salvin and Godman state that they have a nestling from Panama, so the species certainly breeds there, though what race we cannot say. The presence of *vagans* in Santa Marta in June may indicate its breeding there. In Matto Grosso, Brazil, both birds obviously occur together. Fortunately, our series is sufficiently large to pick out representatives of the two races with a reasonable degree of certainty. The same may be said for Ecuador, the birds taken in October, December, and January being obviously large, and April birds obviously small. The Bahia bird again, taken in March, is immature, indicating that it was probably hatched out a few months earlier in the vicinity. If the entire absence of the species from Costa Rica may be taken as an index, *I. p. vagans* breeds north of that country only, but perhaps it breeds in Panama and Santa Marta. That it has not been recorded from Costa Rica at all is surprising when we consider that the bird is common, migrates in flocks, and is not particularly shy.

THE STATUS OF *Crax panamensis* OGILVIE-GRANT

This species was described in the Catalogue of Birds, XXII, p. 479, with a habitat from southern Nicaragua to Colombia and was based on six specimens. The adult male differs from *C. globicera* in having a slight white tip to the tail. The adult female is said to differ from *globicera* in having the tail strongly barred with white both above and below; no white markings on the wing; back of neck, mantle, and chest rufous-chestnut almost devoid of black. So-called "younger" females of both species are more or less barred or freckled with black throughout.

In attempting to identify our Nicaraguan material, we soon found that matters were not as simple as they appeared. *C. globicera* had been recorded from Nicaragua by Nutting and Richmond, but these records had been placed under *panamensis* by Salvin and Godman in the *Biologia Centrali-Americana*. Incidentally, Carriker gives *C. panamensis* from Costa Rica, on the ground that all birds have the tail strongly barred, a far from convincing reason, as "immature" female *globicera* has the tail barred according to Grant.

Turning now to our specimens, an adult male from Nicaragua and no less than three out of four males from Panama prove to be undoubted *globicera*, which is not supposed to range south of Honduras! Of four "adult" females from Mexico, one has no white freckling on the wings, thus supposedly approaching *panamensis*. Four "adult" females from Panama and Colombia correspond quite well to Grant's description of *panamensis*, but one has black barring across the back, and the tail-bars are a different color in each, varying from ochre to yellowish white. We might add that these tail-bars average about 12 mm. in width. Three "immature" females from Nicaragua do not, however, correspond to anything in Grant's descriptions. Two are exactly like "adult" female *globicera* above in being black rather than rufous-chestnut, but a third is intermediate in this character. This latter bird has tail-bars just like our Panama females, but the other two have much whiter and narrower tail-bars averaging 3-4 mm. wide. Finally, these two birds have barred chests and thighs, while the third has none, and we might add that the tail-bars of all three are just as clearly marked on the under surface of the feathers as the upper. It becomes obvious that these three birds represent two plumages which completely connect the alleged differences between the females of the two species. Further, there is no evidence that these various changes in plumage and age are correctly correlated. For birds which vary so remarkably as do these Curassows, a far larger series and study in the field would be required before the age of a specimen can be told by its plumage.

Finally, we had the privilege of examining an excellent series of Mexican *C. globicera* in the U. S. National Museum, thanks to the courtesy of Dr. Charles W. Richmond. Every one of the supposed characters of female *panamensis*, in all ages or stages of Grant's, can be found in this series. We have no hesitation in saying that at present there is not a single reliable character on which to separate these supposed species, and *Crax panamensis* should accordingly become a synonym of *Crax globicera*.

Aramides cajanea AND ITS ALLIES IN CENTRAL AMERICA

In 1907 Outram Bangs published an excellent revision of the Wood Rails of Central America.¹ In this paper he eliminated *chiricote* as a subspecies of *A. cajanea*, considered *plumbeicollis* a race of *albiventris*, and described another race from eastern Mexico. We do not feel able to follow his treatment of *plumbeicollis*, which seems to us strikingly distinct from *albiventris*. We have had a much larger series of this form available and are able to extend its range northward to the Roman River, Honduras, which is just east of Trujillo. This series is absolutely constant, and the Honduras birds do not show the slightest elements of an approach to *albiventris*.

Our series shows that several of Mr. Bangs' characters do not hold. The type of *A. albiventris*, for instance, has an olive-tawny mantle, and consequently is not unicolor on the back, so that this character, which he relies upon in his key to distinguish *plumbeicollis*, is apparently not absolute. We do find, however, that there is a difference between them which has not been brought out. The bills of specimens of *albiventris* from both Guatemala and British Honduras are orange-yellow for the basal two-thirds, the terminal third of the upper mandible being orange-yellow and the lower mandible green. In *mexicanus*, *plumbeicollis*, and the other related species *cajanea*, the whole terminal third of the bill is pale apple-green.

Again, Mr. Bangs separates *cajanea* from *albiventris* and its races in that the back of the head is grayish brown instead of bright chestnut, and the shorter, stouter bill. Here we desire to point out that our excellent series of *plumbeicollis* is intermediate not only in the length of the bill, but in the color of the head, which could not possibly be called chestnut. In fact, in these two characters *plumbeicollis* is much nearer *cajanea* than *albiventris*, a situation which is further emphasized by the color of the abdomen. Below we give a tabular arrangement of the diagnostic characters of the four forms which, we hope, will outline the problem as graphically as possible.

¹*Amer. Naturalist*, XLI, pp. 177-187.

<i>A. albiventris</i>	<i>A. plumbeicollis</i>	<i>A. cajanea</i>	<i>A. mexicanus</i>
1. Bright chestnut crown patch	Bright brown	Dull to bright grayish brown	Bright brown
2. Broad patch of white feathers on abdomen	Narrow patch of buffy feathers	Breast and abdomen uniform chestnut	Narrow patch buffy feathers
3. Generally pale coloration	Dark coloration	Dark coloration	Dark coloration
4. Bill 60-66	Bill 53-61	Bill 50-57	Bill 61-73
5. Terminal third of upper mandible orange-yellow	Light apple-green	Light apple-green	Light apple-green
6. Back usually (?) concolor	Back never concolor	Back concolor	Always concolor, or nearly so
7. Iris yellow	Iris orange-red	Iris orange-red	Iris ?

In addition to these characters, it should be pointed out that, while the bill *length* is a gradual progression from south to north, *cajanea* is proportionately stouter. In the crown character *plumbeicollis* is much nearer *cajanea* than *albiventris*, while *mexicanus* is slightly nearer *albiventris*.

It seems to us on this showing that Mr. Bangs' treatment, in which he makes *plumbeicollis* and *mexicanus* races of *albiventris*, becomes untenable. *A. albiventris* stands out sharply as a very distinct species. The only ground for considering *plumbeicollis* a race of *albiventris* is its close affinity to *mexicanus*, which is stated to intergrade with *albiventris*. This alleged intergradation, however, is based on two specimens which Mr. Bangs calls intermediate, but they come from localities which are not strictly intermediate in the ranges of the two forms, one of them in fact from western Guatemala and the other from central Guatemala, hardly satisfactory proof of subspecific intergradation in the strict sense of the word. Even if this point were waived, the subspecific claims of *plumbeicollis* rest on nothing but *a priori* reasoning, and a second glance at our table of characters shows that, if it is to be a race of anything, its affinities are with *cajanea* rather than *albiventris*.

This view of the case is strengthened by our discovery of a Pacific race of *plumbeicollis* in Nicaragua, to be described below, which differs in being slightly darker, and especially in having lost all traces of light, buffy feathers on the abdomen. This is a step further from *albiventris*, and a *a priori* reasoning to make this bird a race of *albiventris*, with which it has not a single diagnostic character in common, is strained to the breaking

point. *A. plumbeicollis* must be regarded, to our way of thinking, as a distinct species in default of any proof of intergradation with either *albiventris* to the north or *cajanea* to the south.

Further, we think that *mexicanus* must be accorded specific rank until complete intergradation with *albiventris* is established.

Finally, let us bear in mind that these Wood Rails are unquestionably an invasion from South America. The parent stock was originally one species which broke up into four races, as we go northward. Special isolation factors have evolved *albiventris* as the most distinct type. The other species are admittedly close, but intergradation has apparently broken down and disappeared and, in the case of *plumbeicollis*, at least, sufficient time has elapsed for a further secondary racial variation to develop between a very humid Atlantic Coast form and a comparatively dry Pacific form. This race may be known as follows.

***Aramides plumbeicollis pacificus*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *A. p. plumbeicollis*, but mantle less tawny, more olive; back more grayish olive; primaries deep rufous instead of chestnut, the dusky tips darker and more extensive; no light buffy feathers on the abdomen; axillars and under wing-coverts chestnut with narrow black bars. Iris orange-red; eyelids, rictus, and skin of mandibular ramus, legs and feet raspberry-red; basal half of bill dull yellow, terminal half pale apple-green. Wing, 176; tail, 58; culmen, 60; tarsus, 80.

TYPE.—No. 143684, Amer. Mus. Nat. Hist.; ♂ ad.; Tipitapa, Nicaragua; April 28, 1917.

SPECIMENS EXAMINED

Aramides plumbeicollis pacificus.—NICARAGUA, Tipitapa, the type.

Aramides plumbeicollis plumbeicollis.—HONDURAS, Roman River, 1 ♂, 1 ♀; NICARAGUA, Rio Coco, 2 ♂, 2 ♀, 1?, Jalapa, 1 ♂, 2 ♀, Matagalpa, 1 ♀, Los Sabalos, 1 ♀.

Besides the type, one other bird was collected, but was saved as a skeleton. There are three mounted specimens in the Managua Museum. The bird is found in the swampy borders of Lake Managua, a very narrow habitat, as the surrounding country is quite arid.

It will be noted that this race approaches *cajanea* in that the breast and abdomen are uniform chestnut. The axillars and under wing-coverts render it unique, however, in this group. In *mexicanus*, *albiventris*, and *plumbeicollis* these parts are barred black and hazel, to use Mr. Bangs' term, the tips of the feathers frequently being whitish. In *cajanea* these feathers are similar, but the black bars are much broader, and the light tips are slightly fainter. These characters plus the others mentioned in the diagnosis make us feel justified in describing this race on a single specimen.

THE RACES OF *Aramus vociferus*

The Limpkin found in Florida, the Greater Antilles, and Central America, always a local bird, has had a somewhat stormy nomenclatural career, but in spite of the many names it has borne, no one ever seems to have had the intention of dividing it into two or more forms. Systematic study of the larger water-birds is frequently hampered by scanty material, and this is undoubtedly responsible in the present case for the fact that an excellent subspecies of *Aramus vociferus* has been completely overlooked. Very satisfactory material shows that *Aramus vociferus* is restricted to southern peninsular Florida, and that birds from the Greater Antilles and Central America are a readily recognizable race which must be known as follows.

***Aramus vociferus holostictus*¹ (Cabanis)**

SUBSPECIFIC CHARACTERS.—Similar to *A. v. vociferus* of Florida, but much smaller; the ground color very slightly darker and more glossy above, much darker below; noticeably distinct in the great reduction of the white streaking on upper back, scapulars, wing-coverts, and underparts.

SPECIMENS EXAMINED

Aramus vociferus vociferus.—FLORIDA, 9 ♂, 2 ♀, 2 imm.

Aramus vociferus holostictus.—HAITI, 1 ♀, 1 ♀ ?; TEXAS, 1 ♂; MEXICO, 4 ♂, 3 ♀, 3 imm.; NICARAGUA, 1 ♂, 1 ?.

MEASUREMENTS

		Wing	Culmen	Tarsus
Florida	7 ♂	312-334	124-134	123-135
	2 ♀	306-340	112-124	117-129
Haiti	2 ♀	304-309	95- 99	101-109
Central America	6 ♂	290-315	92-126	104-125
	3 ♀	306-319	103-118	102-122

The great difference in the amount of white streaking is the most striking thing about the new subspecies, *holostictus* in this respect being a decided approach to the South American *scolopaceus*, which has no streaking on the mantle and wing-coverts at all. Typical *vociferus* below has almost as much white showing as dark olive-brown, while *holostictus* has much more brown than white, especially on the belly.

The nomenclature calls for some comment. Of the various names by which *vociferus* has been known, *pictus* Bartram is non-binomial; *giganteus* Bonaparte, 1825, founded on the Florida bird, is a synonym of *vociferus*; *guarauna* Wagler (nec Neuwied) is a synonym of *scolopaceus*, leaving *holostictus* Cabanis, 1856, founded on a Cuban bird, which is, so far as

¹This name has already been revived for the Cuban bird by Outram Bangs, as an insular race of *vociferus*.

we know, available, in spite of the fact that Cabanis was only intending to separate the more northern species from *scolopaceus*, apparently unaware that this had already been done by both Latham and Bonaparte.

The two races will stand as follows, with their principal synonymy. It should be noted that both forms will have a place in the A. O. U. Check-List.

1. ***Aramus vociferus vociferus* (Latham)**

Numenius vociferus Latham, (1801), Suppl. Index Orn., LXV, (Florida).

Tantalus pictus Bartram, (1792), 'Trav. Florida.,' p. 291.

Aramus scolopaceus of authors (not Gmelin).

Rallus giganteus Bonaparte, (1825), Journ. Acad. Philad., V, p. 31, (Florida).

RANGE.—Southern peninsular Florida; Okefinokee Swamp, Georgia; casual north to South Carolina.

2. ***Aramus vociferus holostictus* (Cabanis)**

Nothrodicus holostictus Cabanis, 1856, Journ. f. Ornith., p. 426 (Cuba).

Aramus holostictus Slater and Salvin, 1859, Ibis, p. 227 (Belize, Omoa); Salvin, 1870, Ibis, p. 116 (Costa Rica).

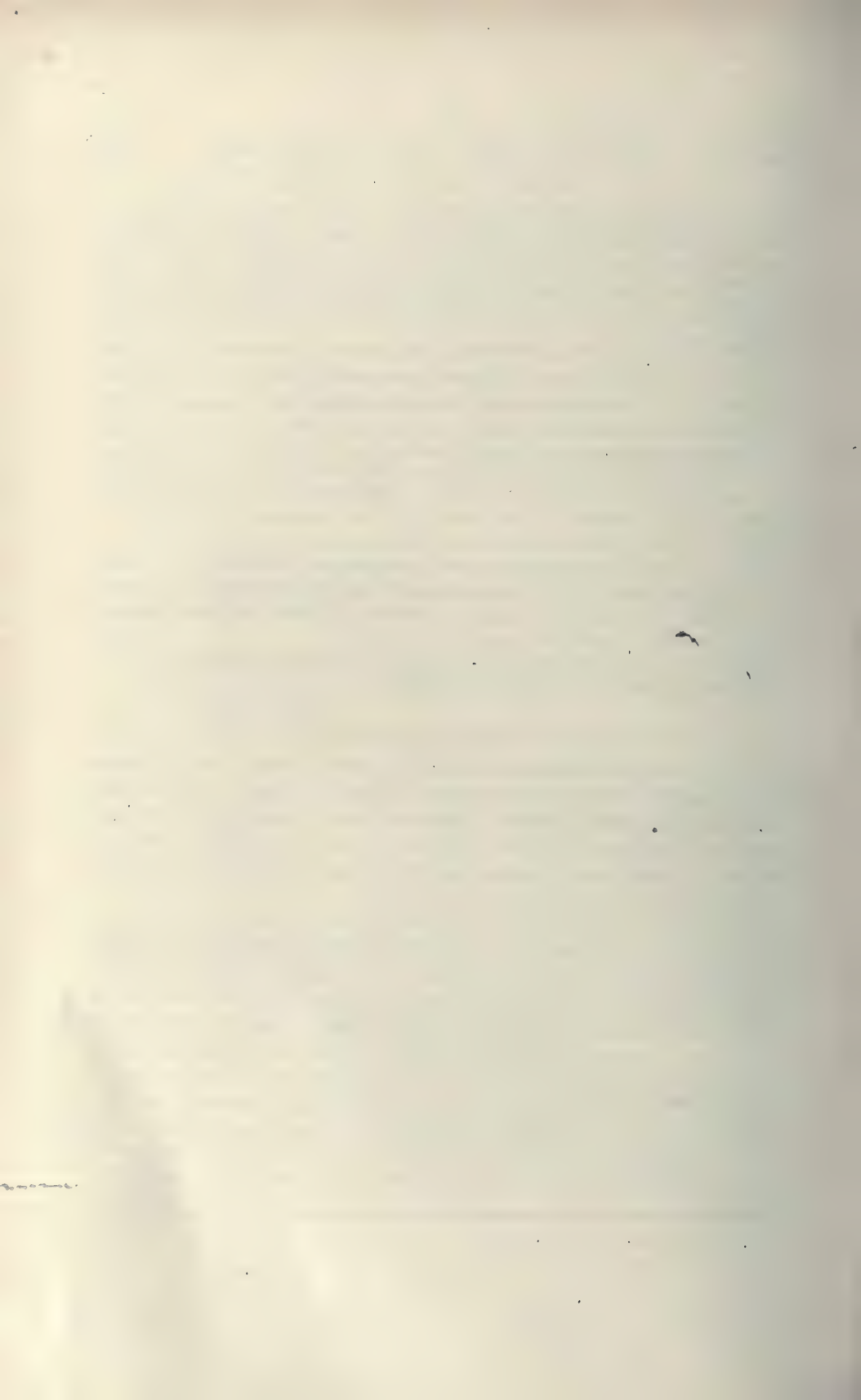
RANGE.—Greater Antilles; Eastern Mexico to Panama; accidental in Texas (Brownsville, May 29, 1889, specimen examined).

THE STATUS OF *Gampsonyx swainsoni leonæ* CHUBB

This remarkable little Kite occurs in Central America only in western Nicaragua, where it is common. Mr. S. H. Chubb of the British Museum has recently proposed¹ the name *leonæ* for these birds. His race was based apparently on one specimen which was alleged to differ in having the upper surface darker and in having the forehead and sides of the face straw-color instead of orange-buff.

In spite of the fact that geographic isolation might well have caused subspecific variation, we find it impossible to maintain this race. Comparison of four Nicaraguan specimens with a large series from South America shows that while the Nicaraguan birds are very slightly darker above than many, they are lighter than others, showing that nothing but individual variation is involved. The intensity of the color of the forehead and sides of the face is equally variable. The Nicaraguan birds consequently, should be known as *Gampsonyx swainsoni meridensis* Swann, a recently described subspecies, to which we also refer specimens from Santa Marta and the north coast of Venezuela.

¹1919, Bull. B. O. C., XXXIX, p. 22.



AMERICAN MUSEUM NOVITATES

No. 26

A NEW POMACENTRID AND BLENNY FROM THE BAHAMAS

By JOHN TREADWELL NICHOLS



Issued December 14, 1921



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A NEW POMACENTRID AND BLENNY FROM THE BAHAMAS

BY JOHN TREADWELL NICHOLS

A small collection of rock pool-fishes obtained by Mr. VanCampen Heilner in the Berry Islands of the western Bahamas in February, 1921, contains the following species here proposed as new.

***Eupomacentrus nepenthe*, new species**

The type, our only specimen, No. 7768, American Museum of Natural History, was taken from rock-pools in the Berry Islands, February 24, 1921, by VanCampen Heilner. It is 61 mm. long to base of caudal. Depth, 2.2 in this length; head, 3.2. Eye and snout equal, 3.4 in head; interorbital and maxillary equal, 3.8; greatest

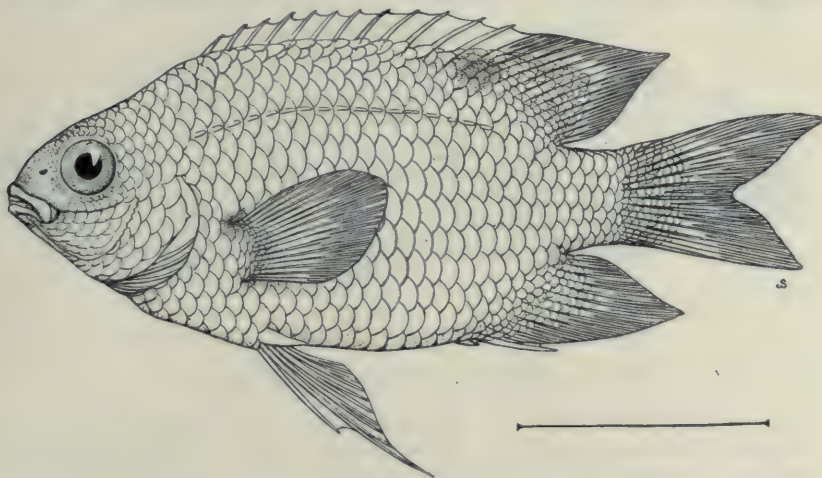


Fig. 1. *Eupomacentrus nepenthe*, type (scale 1 inch).

thickness of body, 1.6; least depth of peduncle, 2.1; longest dorsal spine (last), 1.9; longest dorsal and anal rays (equal), 1.1; second anal spine, 1.9; upper caudal lobe (longest), 0.9; pectoral 1.2; ventral, 0.8.

Dorsal XII, 15; anal II, 13; ventral filaments extend to anal; soft dorsal and anal pointed; scales 28.

The forehead is less elevated than in *Eupomacentrus leucostictus*, with a distinct shallow concavity in the profile back of the eye. The snout is longer, maxillary not reaching to under eye, head larger. Unlike *Eupomacentrus fuscus*, there are many distinct small accessory scales on

the top of the head from the interorbital forward. Color (in spirits) pale, somewhat clouded with dusky above. A small dusky spot on the axil of the pectoral and two or three vague dusky bars in the middle of the side. Pectoral and caudal pale; dorsals, ventrals, and anal more or less washed with dusky, and a vague dusky mark at the base of the first soft dorsal rays. The collector remembered it as uniform dark bluish in life.

Named for the "Nepenthe," a cruising launch, in which the collector has explored the waters of our Atlantic coast.

***Labrisomus heilneri*, new species**

The type, No. 7769, American Museum of Natural History, was collected from rock-pools in the Berry Islands, February 24, 1921, by VanCampen Heilner. It is 61 mm. long to base of caudal. Depth, 4.1 in this length; head, $3.0\frac{1}{2}$. Eye, 4.0 in head; maxillary, 2.0; greatest thickness (the back of the head), 1.5; depth of peduncle, 4.0; longest dorsal spine, 2.9; dorsal ray, 1.8; anal spine, 6.7; anal ray, 2.2; pectoral, 1.3; ventral, 1.5; caudal, 1.7. Interorbital in eye, 2.5.

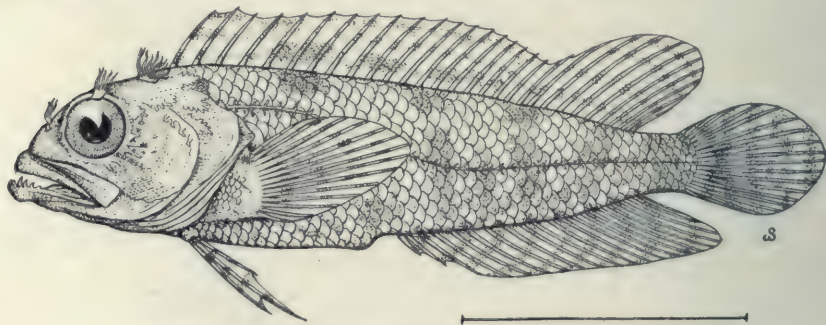


Fig. 2. *Labrisomus heilneri*, type (scale 1 inch).

Maxillary extends back to beyond center of eye. A much divided tentacle over and another before eye, and fringe of tentacles at the nape. Gill-rakers very small, about 9 on the lower limb of the first arch. Dorsal XX, 10. The third dorsal spine shorter than the second and fourth, the nineteenth the shortest, shorter than the twentieth. Anal II, 19. Scales 49; 3 rows between lateral line and front of spinous dorsal; 4 rows between lateral line and front of soft dorsal; about 7 rows between lateral line and front of anal. Color pale with 5 irregular broken dark bars across the side. Pectoral and dorsal marked, ventral, anal and caudal barred with dark; barring on the anal sharp, blackish.

A smaller individual with the same data, 41 mm. to base of caudal, has head, 3.2; eye, 2.6; dorsal XIX, 11; anal II, 17; scales about 50. Five darkish bars across side, the last at base of caudal; fins colorless.

Named for Mr. VanCampen Heilner of Spring Lake, New Jersey, author of "The Call of the Surf," "Record North American Fishes," etc.

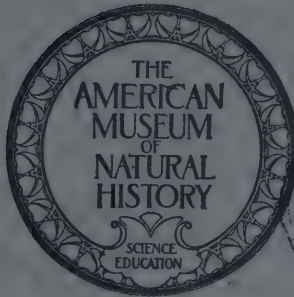


AMERICAN MUSEUM NOVITATES

No. 27

DESCRIPTIONS OF PROPOSED NEW BIRDS FROM BRAZIL, PARAGUAY, AND ARGENTINA

BY GEORGE K. CHERRIE AND (MRS.) ELSIE M. B. REICHENBERGER



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DESCRIPTIONS OF PROPOSED NEW BIRDS FROM BRAZIL, PARAGUAY, AND ARGENTINA

BY GEORGE K. CHERRIE AND (Mrs.) ELSIE M. B. REICHENBERGER

The following descriptions of proposed new birds are based chiefly on birds contained in the Roosevelt Collection made by Mr. Cherrie in the years 1913-1916. They are here published in advance of a complete report on the collection.

Strix chacoensis, new species

SPECIFIC CHARACTERS.—Similar to *Strix rufipes* but general color above and bars below darker; blackish, instead of chocolate-brown, the primary coverts distinctly barred with rufous on both webs, and with facial ruff dusky, barred with grayish white, instead of chocolate-brown or fulvous.

TYPE.—No. 149,387, Amer. Mus. Nat. Hist.; ♂ ad.; Fort Wheeler, Paraguayan Chaco, Paraguay; September 28, 1916; George K. Cherrie.

DESCRIPTION OF TYPE.—Above, dusky brownish black, narrowly barred with white and yellowish buff; the white bars, subapical on the feathers and separated from the basal yellowish buff ones, which are mostly concealed by a rather broad brownish black band; the feathers of the hind neck are long and fluffy; the center of the crown is darker than the upperparts, the blackish tips to the feathers being broader and concealing the white bars; median and greater wing-coverts distinctly but irregularly barred with pale tawny buff and notched on the outer webs with white; on the greater coverts these white tips forming a narrow band; the primary coverts dusky brownish distinctly barred with deep ochraceous buff; the white bars on the scapulars very distinct; quills dusky brown barred (broadly on the primaries, narrowly on the secondaries) on both webs with ochraceous orange but shading into light ochraceous buff on the edges of the outer webs; tail dusky brown crossed with six bars of pale ochraceous buff that shades into buffy white near the edges of the feathers; loreal plumes silvery white but with the shafts of the plumes developed into black hair-like bristles; remainder of the facial disk dusky grayish white with concentric bars of dusky brown; ear-coverts grayish white with nearly obsolete dusky brown bars and silvery white shaft-lines; under surface of body barred, blackish brown and white; middle of belly, sides of flanks, thighs, and tarsi ochraceous buff; under tail-coverts light ochraceous buff tipped with white and having a subterminal black band followed by a white one; under wing-coverts and axillaries ochraceous buff, a few of the lowermost outermost dusky brownish; the basal third (more or less) of the inner webs of the primaries and secondaries uniform pale ochraceous buff. ♂: wing, 251; tail, 146; culmen, 33 mm.

SPECIMENS EXAMINED

Strix chacoensis.—PARAGUAY: Paraguayan Chaco, Fort Wheeler, 1 ♂ (type).

Strix rufipes.—CHILE: Maquehue, Temuco, Cautin, 1 ♂, 1 ♀.

Although we have only one specimen of this form its characters are so well marked that we have no hesitation in describing it as a new species. *Strix rufipes* has been recorded by Dr. Dabbene from the western part of the Province of Jujuy, Argentina, but whether the record is based on true *rufipes* or the bird here described we are unable to say.

***Ortalis canicollis pantanalensis*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Ortalis canicollis canicollis* of the Paraguayan Chaco, but uniformly darker both above and below; the chestnut color on the outer rectrices more restricted and the head dusky brown; top of the head dusky brown shading into olive-brown on the neck and becoming grayish in the supraloral and supra-auricular regions; bristle-like feathers of the anterior part of the cheeks and chin black, shading into the gray of the sides of face and throat; back of neck, mantle, wings, center of lower back and upper tail-coverts olive-brown with slight bronze or purplish gloss; under wing-coverts, sides, flanks, and under tail-coverts chestnut; chest and breast brownish or olivaceous gray, washed with chestnut on the belly; three outer pairs of tail-feathers broadly tipped with chestnut, the distal third of the outer pair being so colored. ♀: wing, 239; tail, 252; culmen, 25; tarsus, 66 mm.

TYPE.—No. 127,232, Amer. Mus. Nat. Hist.; ♀, ad.; near mouth of Rio San Lorenzo, Matto Grosso, Brazil; December 26, 1913; George K. Cherrie.

***Ortalis canicollis grisea*, new subspecies**

SUBSPECIFIC CHARACTERS.—Very similar to *Ortalis canicollis canicollis* of the Paraguayan Chaco but smaller, the throat dark gray, breast and chest gray with an olivaceous wash; tail bluish green, instead of brownish green, the two outer pair only of tail-feathers tipped with chestnut; sides and flanks pale dusky rufous instead of chestnut as in *Ortalis c. canicollis*; top of head uniform dark gray shading into olive-gray on the nape and becoming brownish olivaceous on the back with a slight bronze gloss; lower back and rump washed with chestnut rather browner down the middle; throat dark gray, breast and chest gray with an olivaceous wash; abdomen paler gray with faint rufescent wash; under tail-coverts chestnut; flanks and sides pale dusky rufous; the two outer pair only of tail-feathers tipped with chestnut. ♀: wing, 210; tail, 238.5; tarsus, 58; culmen, 23 mm.

TYPE.—No. 140,257, Amer. Mus. Nat. Hist.; ♀, ad.; Suncho Corral, Santiago del Estero, Argentina; April 22, 1916; Miller and Boyle.

SPECIMENS EXAMINED

Ortalis canicollis grisea.—ARGENTINA: Suncho Corral, Santiago del Estero, 800 feet, 1 ♀ (type).

Ortalis canicollis canicollis.—PARAGUAY: Fort Wheeler, 1 ♂, 1 ♀. ARGENTINA: Embarcacion, Prov. of Salta, 1700 feet, 1 ♀ (intermediate between *grisea* and *canicollis*).

Ortalis canicollis pantanalensis.—BRAZIL: Palmiras, Rio Taquary, 1 ♀; Rio San Lorenzo, 1 ♀.

Ortalis ruficauda.—VENEZUELA: Cristobal Colon, Paria Peninsula, 1500 feet, 2 ♂, 2 ♀; Tucacas, Estado Falcon, 2 ♂.

This group shows considerable geographic variation. The bird from the Rio San Lorenzo, Matto Grosso (*Ortalis c. pantanalensis*), is the brown extreme; the bird from Suncho Corral, Santiago del Estero, Argentina, is the gray extreme of the species. Specimens from Fort Wheeler, Paraguay (*Ortalis c. canicollis*) and a specimen from Embarcacion, Prov. de Salta, Argentina are intermediate in color. We believe, however, that the material at hand warrants the recognition of three races.

These birds are found in forested areas. *Ortalis c. pantanalensis* was found in the forests which border the watercourses traversing the plains. *Ortalis c. grisea* and *Ortalis c. canicollis* (intermediate) were found in a rough or broken highland forested country. In going from the Paraguayan Chaco into the pantanal region of Matto Grosso, there is a marked difference in the brush and tree flora.

KEY TO THE *Ortalis ruficauda*-*canicollis* GROUP

A. Only middle pair of tail-feathers without rufescent tips. . . . *Ortalis ruficauda*.

AA. Six or eight central tail-feathers without rufescent tips.

b. Head gray.

c. Six middle tail-feathers without rufescent tips; sides dark chestnut, this color nearly meeting across the rump, wing larger, ♀, 227.5 mm. *Ortalis canicollis canicollis*.

cc. Eight middle tail-feathers without rufescent tips; sides pale rufescent, wing smaller, ♀, 210 mm. *Ortalis canicollis grisea*.

bb. Head brown.

c. Six middle tail-feathers without rufescent tips.

Ortalis canicollis pantanalensis.

Nystactes tamatia interior, new subspecies

SUBSPECIFIC CHARACTERS.—Similar to *Nystactes tamatia tamatia* but differing from all described races of *Nystactes tamatia* in its longer wing, in being less heavily spotted, and in having no black spots on the center of the abdomen. ♂: wing, 78; tail, 61.5; culmen, 22.5 mm.

TYPE.—No. 127,486, Amer. Mus. Nat. Hist.; 1 ♂; Campos Novos, Cerro do Norte, Matto Grosso, Brazil; February 16, 1914; George K. Cherrie.

SPECIMENS EXAMINED

Nystactes tamatia interior.—BRAZIL: Campos Novos, Cerro do Norte, Matto Grosso, 1 ♂, 1 ♀, (incl. type); Tapirapoan, 1 ♀.

Nystactes tamatia tamatia.—BRITISH GUIANA: 2 ?.

Nystactes tamatia hypnaleus.—BRAZIL: Santarem, 2 ?, 1 ♀.

Nystactes tamatia pulmentum.—ECUADOR: Napo, 1 ?.

MEASUREMENTS

<i>Nystactes tamatia tamatia</i>	Sex	Wing	Tail	Culmen
British Guiana	?	72.	64.	24.
"Guiana"	?	75.	60.5	23.
<i>Nystactes tamatia hypnaleus</i>				
Brazil: Santarem	?	77.	66.	26.
" "	?	74.	62.	24.
" "	♀	79.	69.	25.5
<i>Nystactes tamatia pulmentum</i>				
Ecuador: Napo	?	75.	59.	24.
<i>Nystactes tamatia interior</i>				
Brazil: Matto Grosso, Campos Novos	♂	78.	61.	22.5
" " " " "	♀	82.5	68.5	25.
" " " Tapirapoan	♀	80.	67.5	23.

The discovery of this race extends the known range of its species. We have seen no specimens from Cayenne, the type-locality of *Nystactes tamatia tamatia*, but we presume material from British Guiana to be essentially topotypical.

***Nonnula ruficapilla pallida*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Nonnula ruficapilla ruficapilla*, but generally paler, the gray of the sides of the head and throat not encroaching on the breast and much less extended on the sides; middle of belly pale ochraceous buff, upperparts and tail olive-brown. ♀: wing, 61.5; tail, 63; culmen, 22.5 mm.

TYPE.—No. 127,126, Amer. Mus. Nat. Hist.; ♀ ad.; Tapirapoan, Matto Grosso, Brazil; January 14, 1914; George K. Cherrie.

SPECIMENS EXAMINED

Nonnula ruficapilla pallida.—BRAZIL: Matto Grosso, Tapirapoan, 2 ♂, 1 ♀, (incl. type).

Nonnula ruficapilla ruficapilla.—PERU: Tulumayo, 4000 ft., Prov. Junin, 2 ♂, 1 ♀, 1 ?.

It is obvious that this subspecies is a pale representative of the Peruvian bird.

***Chloronerpes flavigula magnus*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Chloronerpes flavigula flavigula*, but larger throughout, especially in the length of the wing, and with a heavier bill. ♀: wing, 122; tail, 63; culmen, 21 mm.

TYPE.—No. 127,495, Amer. Mus. Nat. Hist.; ♀ ad.; Monte Cristo, Matto Grosso, Brazil; March 18, 1914; Leo E. Miller.

SPECIMENS EXAMINED

Chloronerpes flavigula magnus.—BRAZIL: Matto Grosso, Monte Cristo, 1 ♂, 1 ♀, (incl. type); Santarem, 1 ♀.

Chloronerpes flavigula flavigula.—BRITISH GUIANA: 1 ♂, 1 ♀; Tumatumari, Potaro River, 250 feet, 3 ♂; Potaro Landing, 1 ♀; Rockstone, Essequibo River, 150 feet, 2 ♀. VENEZUELA: La Union, Caura, 2 ♂, 2 ♀; Suapure, 1 ♀; foot of Mount Duida, 1 ♀.

MEASUREMENTS

	Sex	Wing	Tail	Culmen
<i>Chloronerpes flavigula flavigula</i>				
British Guiana: Tumatumari, Potaro River	♂	118.	65.	20.
British Guiana: Tumatumari, Potaro River	♂	113.5	64. ¹	18.5
British Guiana: Tumatumari, Potaro River	♂	117.5	61. ¹	20.
British Guiana	♂	114.	65.	17.
" "	♀	117.5	66.	19.
" " Rockstone, Essequibo River	♀	113.	64.5	19.5
British Guiana: Rockstone, Essequibo River	♀	114.5	63.	19.
British Guiana: Potaro Landing	♀	113.	60.	18.5
Venezuela: La Union, Caura	♂	114.	66.	19.
" " " "	♂	112.	58.	19.
" " " "	♀	114.	65.	19.5
" " " "	♀	109.	60.	18.
" Suapure	♀	117.5	66.5	19.
" foot of Mount Duida	♀	117.5	65.	19.
<i>Chloronerpes flavigula magnus</i>				
Brazil: Monte Cristo	♂	121.	62.	21.
" " "	♀	122.	62.	21.
" Santarem	♀	123.	64.	18.5

We have seen no birds from Cayenne, the type-locality of *Chloronerpes f. flavigula*, but we believe material from British Guiana to be essentially topotypical. We refer the specimen from Santarem to *Chloronerpes f. magnus*. The wing measurement of this bird is greater than in any other specimen, although the culmen is intermediate in size.

***Furnarius rufus paraguayæ*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Furnarius rufus rufus*. The upperparts slightly darker, crown browner, and forehead deeper rufescent, size much smaller. ♂: wing, 87.5; tail, 65.5; culmen, 19 mm.

TYPE.—No. 149,516, Amer. Mus. Nat. Hist.; ♂ ad.; Puerto Pinasco, Paraguay; September 5, 1916; George K. Cherrie.

¹Tail moulting.

SPECIMENS EXAMINED

Furnarius rufus paraguayæ.—PARAGUAY: Puerto Pinasco, 1 ♂ (type); Trinidad, 1 ♂.

Furnarius rufus rufus.—ARGENTINA: Buenos Aires, 3 ♂; Montevideo, 1 ?.

Furnarius rufus badius.—BRAZIL: La Raiz, foot of Organ Mountains, 2 ♂.

Furnarius rufus commersoni.—BRAZIL: Chapada, Matto Grosso, 3 ♂, 3 ♀; Urucum, near Corumbá, Matto Grosso, 3 ♂, 4 ♀. ARGENTINA: Perico, Prov. of Jujuy, 1 ♂; Embarcacion, Prov. of Salta, 2 ♂.

MEASUREMENTS

<i>Furnarius rufus paraguayæ</i>	Sex	Wing	Tail	Culmen
Paraguay: Puerto Pinasco, Rio Paraguay	♂	87.5	65.5	19.
" Trinidad	♂	93.	66.5	17.
<i>Furnarius rufus rufus</i>				
Argentina: Buenos Aires	3 ♂	97-113	68-76	20-21.5
Uruguay, Montevideo	?	101.	78.	21.5

A series from the mountains of Bolivia, Parotani, Department of Cochabamba and from the vicinity of Sucre, Department of Chuquisaca (alt. 8600-8700 feet), as well as a series from Argentina, Province of Jujuy and Province of Salta (alt. 4000 feet), are intermediate between *Furnarius r. rufus* and *Furnarius rufus commersoni*, for they have the nape as rufescent as *F. rufus commersoni*, and the color of the lower parts nearer to *F. rufus rufus*.

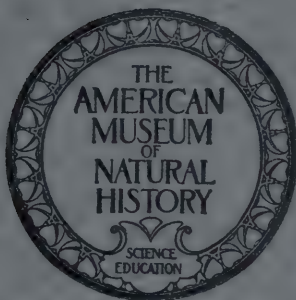
• These birds are found chiefly at the edges of the heavily forested areas that separate the open country cultivated or otherwise. They seem to show a decided preference for building their nests in or near native houses, and are quite fearless.

AMERICAN MUSEUM NOVITATES

No. 28

NEW SPECIES OF AMMONITE OPERCULA FROM THE MESOZOIC ROCKS OF CUBA

BY MARJORIE O'CONNELL



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INTRODUCTION

Among the material collected by Mr. Barnum Brown in 1919 in the Province of Pinar del Rio, western Cuba, are seventeen specimens and numerous fragments of the small calcareous, bivalved shells which are known as aptychi. They are the opercula with which the ammonites closed up the aperture of the conch after the animal had withdrawn into the body chamber.

So far as I know there has been only one occurrence noted of an *Aptychus* in American Mesozoic formations. Castillo and Aguilera described *Aptychus mexicanus* from the Jurassic rocks of Sierra de Catorce, San Luis Potosi, Mexico,¹ and this seems to have been a sporadic occurrence. But in Cuba there is a definite horizon which has been traced for several miles and at which nothing but aptychi and an occasional small *Haploceras* are found. The rocks consist of alternating shales and limestones with the former predominating. They are dark gray but weather light brown or almost white and show a considerable amount of iron stain. The aptychi occur on the surfaces of the shale and are well preserved, although very fragile on account of the iron impregnation. The *Aptychus* beds were discovered in the heart of the Organ Mountains in outcrops along two stream beds, the Rio San Cristobal and Rio Hondo, northeast of the town of San Cristobal and northwest of Candelaria. From the field relations and the general stratigraphy, these strata appear to be of Upper Jurassic age, but the aptychi themselves possess certain characteristics which have heretofore been found only in Cretaceous species. Until further field work can be done it is impossible to state the exact age of the beds but it must be either Tithonian or Neocomian with the palæontological evidence strongly favoring the latter.

¹Castillo, Antonio del and Aguilera, Jose G. 1895. 'Fauna Fossil de la Sierra de Catorce, San Luis Potosi.' Boletin de la Comision Geológica de México, I.

HISTORY OF INVESTIGATIONS AND CLASSIFICATION OF OLD WORLD
APTYPCHI

Hermann von Meyer in his paper 'Das Genus *Aptychus*' (1831), proposed the generic name *Aptychus* for the paired plates found within the body chamber of many species of ammonites. While he did not recognize the true significance of the plates, he distinguished correctly between two different types which he described as *A. lævis* and *A. imbricatus*, each with two varieties. These have since been recognized as representatives of two large groups, the Cellulosi and the Imbricati, respectively.

There is no monographic work on *Aptychus*, the descriptions of species being scattered through the literature in short papers. Since the opercula are often found in formations containing few or no ammonites, it would be exceedingly valuable if all of the data concerning the geological range of every known species of *Aptychus*, as well as the ammonite genera to which they belong could be brought together. Such a study would have to be undertaken in Europe where *Aptychus* beds are common, for in America up to the present few representatives of this genus have been found and material is not available for carrying on researches on the subject. On page 12 below is given a short and by no means complete bibliography of the more important references dealing with the morphology and taxonomy of aptychi and the stratigraphic range of Jurassic and Cretaceous species.

The systemic position of the bivalved *Aptychus* plates was formerly a subject for much discussion and a large amount of the early literature was devoted to it. The various theories advanced concerning the type of organisms to which the aptychi belonged may be found in the contributions by Parkinson (1811), Meyer (1831), Voltz (1837), Coquand (1841), and Quenstedt (1849). It is now generally accepted that the aptychi are ammonite opercula, as is indicated by their position *in situ* in the body chamber in many specimens. Oppel has figured and described, from the Solnhofen beds of Bavaria, a large number of ammonites with aptychi in the body chamber or at the aperture (see reference on p. 13 for Oppel 1863) and other authors have recorded sporadic occurrences of aptychi *in situ* (e.g., Meyer, 1831, Retowski, 1891, 1893).

Aptychus is not a genus; it is simply a convenient term for referring to opercula when the ammonites to which they belong are unknown. When an aptychus is found *in situ* in an ammonite it does not receive a separate specific name but is known as the aptychus of that particular genus and species of ammonite. But when aptychi occur alone, as they

frequently do, with no ammonites in the same stratum, then for convenience in referring to them they are given specific names. If an aptychus thus named is subsequently found to be the operculum of an ammonite which had previously been described, the aptychus should be called by the specific name of the ammonite, while the specific name which had been used for the aptychus would become a synonym. Each species of ammonite that possessed an operculum in all probability possessed a distinctive type and, conversely, when different types of aptychi are found we may assume that they belonged to separate ammonite species.

When aptychi are sectioned they are found to be made up of three shell layers of which the inner and outer are very thin and dense, while the middle is thick and cellular or tubular (Figs. 1, 2, 4, 6). The outer and inner layers are frequently destroyed during fossilization, leaving

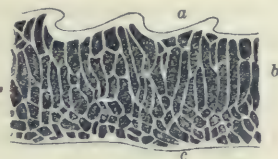


Fig. 1. Vertical section of the shell of *Aptychus profundus* Voltz, showing the three shell layers (a, b, c).

Greatly magnified. Upper Jurassic (after Meneghini and Bornemann from Zittel).

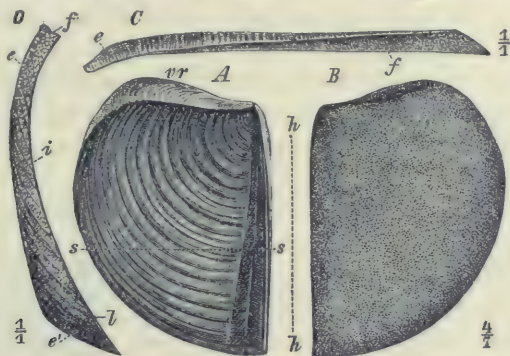


Fig. 2. *Aptychus lævis* Meyer, the aptychus of a species of *Aspidoceras*.

A. Interior view of a valve showing the growth-lines. B. Exterior of same; h-h, junction line. C. Inner edge of the valve; f, junction surface. D. Vertical section through the valve along the line s-s, of A; i, growth-lamellæ merging externally (e) but thickening toward the interior (l). Upper Jurassic, Kimmeridgian, Le Havre, France. (After Steinmann.)

the more resistant middle one. Aptychi increase in size by the addition of concentric bands of shell around the periphery. The edges of these bands, covered only by the thin outer layer, may show on the convex surface like the ends of off-lapping shingles or they may bend over each other so closely as to show only concentric lines on the external surface.

The internal surface is marked by crowded growth-lines, which are sometimes crossed by radial lines from the apex.

A classification of aptychi has gradually been evolved and, as added to and emended by Zittel (1885, pp. 402-403), now includes seven groups based on the shape and thickness of the shell, the character of the surface



Fig. 3. *Aptychus lamellosus* Voltz.

Exterior view. Upper Jurassic, Solnhofen, Bavaria. Natural size. (After Zittel.)

layer and of the lamellæ. The three most abundantly represented groups in the Upper Jurassic and Lower Cretaceous (Neocomian) are the Cellulosi, Imbricati and Punctati. The Cellulosi are forms with thick curved plates having a fine porous, convex external surface and a concave internal surface covered with fine growth-lines (Fig. 2). The Imbricati have thinner shells and usually the small posterior end is very thick. The convex surface is covered with shingle-like lamellæ, the edges of which appear like folds in some cases or like sharp knife-edges in others, the crests being separated by depressions which are rounded or angular (Figs. 1 and 3). The inner surface has concentric growth-lines. The aptychi of this group are found in various species of the Oppeiliinæ in the Upper Jurassic, especially at Solnhofen and in the Lower Cretaceous and are also found isolated in the various *Aptychus* shales and limestones. The Punctati (Fig. 4) are similar to the Imbricati except that the lamellæ overlap more closely

and the crests are bent over until they cover up the intervening hollows; the edges of the crests are marked by lines of punctæ on the external surface. The outer shell layer is thicker than in the Imbricati and the distinctness of the lines of punctæ depends upon the degree to which erosion of this layer has progressed, the punctæ being etched out when the amount of erosion is slight, but if this continues the lamellæ are worn smooth. Illustrations of these types maybe found in the works cited below, especially Quenstedt (1849) and Zittel (1885).

The *Aptychus* shale of Cuba contains three species all belonging to the Imbricati and all well represented. No other fossils have been discovered in this formation except a few small ammonites belonging to the

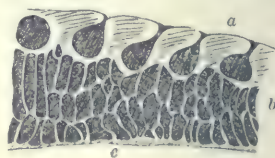


Fig. 4. *Aptychus punctatus* Voltz.

Vertical section showing three shell layers (a, b, c). Greatly enlarged. (After Meneghini and Bornemann from Zittel.)

family of the Haploceratidæ. The determination of the age of the beds therefore depends upon the evidence offered by the aptychi themselves without the aid of the ammonites to which they belonged.

In Europe aptychi have been found throughout the Jurassic and Cretaceous of many regions. In certain localities, particularly in Bavaria in the Solnhofen beds, they are usually found *in situ* in the body chamber of the ammonite shell. Elsewhere they occur segregated in beds by themselves, as is the case in the Tithonian *Aptychus* limestones of the Alps and Apennines and in the Eo-Cretaceous or Neocomian *Aptychus* limestones of the eastern Alps.

The Imbricati, those semi-elliptical to quadratic forms with overlapping lamellæ on the convex surface and fine concentric lines on the concave surface, are the most abundant and widespread. They occur in great numbers associated with conchs belonging to the subfamily of the Oppeliinæ and to the family of the Haploceratidæ, and also alone. The Jurassic Imbricati for the most part have the lamellæ parallel to the curved periphery of the outer edge of the aptychus, as in *A. lamellosus* Voltz from the Solnhofen beds (Fig. 3). The lamellæ, in other words, extend in a continuous curve from the anterior to the posterior end, without bending back toward the apex and forming an angle on the posterior slope. All of the Jurassic Imbricati of this type may be united into the *A. lamellosus* group, including the following forms as representative species:

<i>Aptychus crassicauda</i> Quenstedt	Middle White Jura
<i>A. sparsilamellosus</i> Gümbel	Upper Jurassic (<i>Acanthicus</i> beds)
<i>A. lamellosus</i> Voltz	Upper Jurassic (Solnhofen beds)
<i>A. profundus</i> Voltz (= <i>A. imbricatus</i> Meyer)	" " " "
<i>Aptychus</i> of <i>Oppelia bous</i> (Oppel)	" " " "
" " <i>O. euglyptus</i> (Oppel)	" " " "
" " <i>O. lithographica</i> (Oppel)	" " " "
" " <i>O. thoro</i> (Oppel)	" " " "

The Cretaceous Imbricati are distinguished from those of the Jurassic in having the lamellæ bent toward the apex as they approach the line of junction (Figs. 5, 6). In some species, notably *A. didayi* Coquand, there is an acute angle formed on the posterior slope. These forms constitute the *A. didayi* group, including as representative species:

<i>Aptychus angulocostatus</i> Peters	Lower Cretaceous (Neocomian)
<i>A. didayi</i> Coquand	" " "
<i>A. lineatus</i> Peters	" " "
<i>A. pusillus</i> Peters	" " "
<i>A. seranonis</i> Coquand	" " "
<i>A. undalocostatus</i> Coquand	" " "
<i>A. insignis</i> Hébert	Upper Cretaceous (Mæstrichtian)

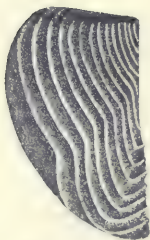


Fig. 5. *Aptychus didayi* Coquand.

Natural size.
Lower Cretaceous,
Neocomian, Central
France. (After Pic-
tet.)

The same distinction exists between the Jurassic and Cretaceous Punctati, the former having the lamellæ essentially parallel to the outer curved periphery, the latter having them bent into an angle along the posterior slope. As examples of the Jurassic species may be mentioned: *Aptychus punctatus* Voltz and *A. beyrichi* Oppel; of the Cretaceous species: *A. rugosus* Sharpe from the Mæstrichtian of England.

The species found in the *Aptychus* shales north of San Cristobal in Cuba all belong to the Imbricati and to the *didayi* rather than the *lamellosus* group. In all of them the lamellæ are bent more or less sharply on the posterior slope and turn towards the line of junction of the plates, meeting it either at a right angle, as in *A. cubanensis*, or at an acute angle toward the apex, as in *A. pimientensis* and *A. cristobalensis*, but never at an acute angle away from the apex, as in *A. lamellosus* Voltz and related species of that group. The Cuban species are altogether Cretaceous in their appearance, being most like *A. didayi* Coquand and *A. insignis* Hébert. They are smaller than the two latter and narrower than *A. didayi* but the type of lamellæ is the same in all of them. Either the Cuban species belong to the Cretaceous or else they are to be regarded as late Tithonian forerunners of the Cretaceous types. The following new species are described from the region north and northeast of San Cristobal¹:

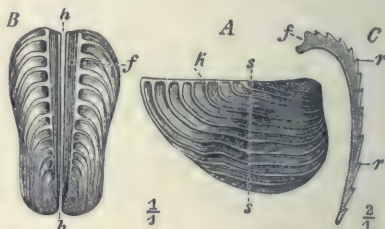


Fig. 6. *Aptychus* of *Haploceras*.

A. Side view of valve showing posterior angulation; B. Exterior of both valves. Anterior or proximal end below, posterior or distal end above. Lamellæ meet exterior junction line at right angle. *f*, triangular junction surface bounded interiorly by *h-h*, the interior line of junction (*Harmonielinie* or *Symmetrielinie*). C. Vertical section through one valve along the line *s-s* in A, showing the folds *r* off-lapping from the inner to the outer margin. Lower Cretaceous, Neocomian of Chalançon, Drôme, France. (After Steinmann.)

Species	Locality	Locality	Locality	Locality
	No. S. C. 2	No. S. C. 3	No. S. C. 4	No. S. C. 5
<i>Aptychus cristobalensis</i>	1	3		
<i>A. cubanensis</i>	5		3	
<i>A. pimientensis</i>		2		3

¹The details concerning the exact localities are given under the descriptions of the species.

DESCRIPTION OF NEW SPECIES FROM CUBA

Group of the Imbricati

***Aptychus cristobalensis*, new species**

Figures 7 and 8

DESCRIPTION OF THE HOLOTYPE (Amer. Mus. No. 19017/3).—The shell is calcareous, thin at the apex (anterior) and thick at the narrow distal (posterior) end. The length of the outer junction line is 29 mm., the greatest width 17 mm. and the cord of the peripheral arc from the distal to the proximal ends is 30.7 mm. The broad truncated end is about 10 mm. long. At the apex the three shell layers together are only 0.3 mm. thick; at the distal end the thickness is 6.0 mm.

The curved periphery is bounded by a narrow smooth shell band, which widens toward the distal end where it is perpendicular to the convex surface of the plate. Each half of the aptychus is nearly flat in the early growth stages. It becomes gently convex along the short diameter but extremely convex along a radial line at about one-third the distance between the long and short diameters. This convexity is so pronounced as to give rise to a ridge from which the shell slopes down abruptly to the external junction line (i. e., the long diameter).

At the apex of each plate there are numerous, almost invisible growth-lines, each of which marks the edge of a lamella. Each additional growth-band is broader than the preceding but the first fifteen lamellæ are so narrow as to be scarcely distinguishable to the naked eye. They are arranged like shingles except that they off-lap instead of overlap away from the apex. The last ten lamellæ are broad but only a few are continuous from end to end of the shell. The last four or five wedge out along the periphery, each succeeding one being shorter. It is in this manner that the shape of the aptychus is determined, the broadest part being in the region where all the lamellæ are present, the narrow end being occupied by only a few. The lamellæ become very thin toward the truncated proximal end and terminate nearly at right angles thereto, there being a narrow smooth band at the edge. In the opposite direction, the lamellæ show a slight offset toward the apex as they approach the convex radial ridge, and after they cross it they curve back toward the apex, ending abruptly at the junction line. This flexure is angular until the aptychus is about half-grown, the angle being slightly less than 90°. On the remainder of the shell the flexure loses its sharp angularity, becoming rounded and more open with a divergence of 110–120°.

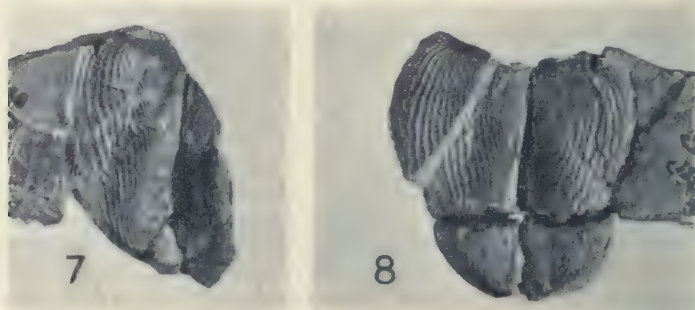
The inner, concave side of the aptychus is covered with fine concentric, evenly-spaced growth-lines about 0.1 mm. apart (Fig. 7).

DESCRIPTION OF PARATYPE No. 19017/2.—Length 30 mm., greatest width about 16 mm., cord of the peripheral arc 33.2 mm. long. Truncated proximal end about 10 mm. long, thickness of distal end 5.5 mm. Outline of two plates in juxtaposition is semi-elliptical. The junction surface is smooth and at right angles to the convex shell surface. It is triangular in shape with its apex at the point of origin of the plate whence it increases to a width of 3.2 mm. at the distal end. It is faintly concave but the three bounding lines are straight. Between the junction plate and the inside or concave surface of the aptychus there is a bevelled edge (Fig. 8).

NUMBER OF SPECIMENS.—Holotype and 3 paratypes.

ASSOCIATED SPECIES.—*Aptychus pimientensis*, new species, at locality No. S. C. 3.

LOCALITIES.—Northeast of Mt. Pimiento in Rio Hondo, 7 miles northeast of San Cristobal (locality No. S. C. 3) 3 specimens, Nos. 19017/1, 19017/2, 19017/3 (holotype); on Finca of Rafael Begoa, 9 miles north of San Cristobal in Rio San Cristobal (locality No. S. C. 2) 1 specimen of immature individual, No. 19017/4.



Figs. 7 and 8. *Aptychus cristobalensis*, new species.

Fig. 7. Oblique side view of one valve showing curvature of lamellæ on posterior slope. The interior of the other valve is shown at the right, the valve being thrust forward. Natural size. Holotype, A. M. N. H. No. 19017/3.

Fig. 8. Top view of both valves in position. Natural size. Paratype, A. M. N. H. No. 19017/2.

Comparisons.—This species belongs to the group of which *Aptychus didayi* Coquand is the most widespread European representative. It is, however, relatively narrower than that species and has much finer lamellæ, while the pronounced flexure of the lamellæ of the fullgrown shell is rounded and not angular. (See Coquand, 1841, p. 389, Pl. ix, fig. 10, and Quenstedt, 1842, p. 314, Pl. xxii, fig. 21.) It agrees very closely with the description of *A. angulocostatus* Peters (1854, p. 441) but that author did not give an illustration of his species and the European types are not accessible to me, so that it would be unsafe to identify the Cuban form with that species. *A. cristobalensis* probably belongs to a species of *Oppelia*.

Horizon of Related European Species.—*Aptychus didayi* Coquand is a characteristic Lower Cretaceous (Neocomian) species occurring throughout the Mediterranean province in southern France, in the eastern Alps, in Austria and northern Africa. (Compare Fig. 7 with Fig. 5.) *Aptychus angulocostatus* Peters is found associated with *A. didayi* in the Neocomian Wienerwald sandstone of Austria and Bohemia (Peters, 1854, p. 441; Paul, 1889, pp. 59, 175).

***Aptychus cubanensis*, new species**

Figures 9 to 14

DESCRIPTION OF THE HOLOTYPE (Amer. Mus. No. 19018/2).—Length of the junction line 17 mm.; greatest width of one valve, 9 mm. On the posterior slope the lamellæ curve to meet the external line of junction at right angles and assume their maximum size and saliency as they approach this line. The last three or four lamellæ to be formed do not extend completely around each half of the aptychus but wedge out

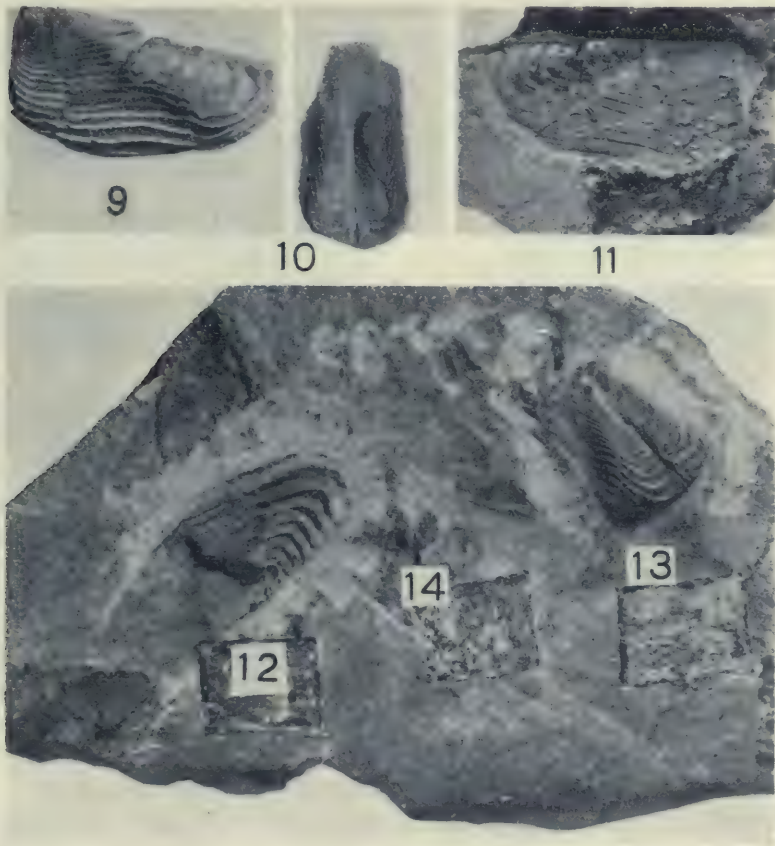
Figs. 9 to 14. *Aptychus cubanensis*, new species.

Fig. 9. Side view showing lamellæ meeting external junction line at right angles. $\times 2$. Holotype, A. M. N. H. No. 19018/2.

Fig. 10. Top view of immature aptychus with both valves in juxtaposition. $\times 2$. Paratype, A. M. N. H. No. 19018/1.

Fig. 11. Exterior. $\times 2$. Paratype, A. M. N. H. No. 19018/3.

Fig. 12. View of posterior end of a broken valve showing the lamellæ meeting external junction line at right angles. $\times 2$. Paratype, A. M. N. H. No. 19018/6.

Fig. 13. Exterior of two valves of nepionic aptychus. $\times 2$. Paratype, A. M. N. H. No. 19018/7.

Fig. 14. Exterior of immature aptychus showing two valves in juxtaposition along junction planes. $\times 2$. Paratype, A. M. N. H. No. 19018/8.

along the curved periphery. On the long anterior surface the lamellæ are thin and sharp but as they increase in size posteriorly their edges become rounded and they appear more like folds separated by channels than like overlapping knife-edges. The external line of junction is thickened and elevated and it serves to form a very definite boundary for the lamellæ (Fig. 9).

DESCRIPTION OF PARATYPES.—On Specimen 19018/7 (Fig. 13), 11 mm. long, 20 lamellæ were counted, this not being the total number since the finer ones near the apex were too small to be distinguished. The two valves are shown in contact along the junction line and when in this position the posterior slopes are horizontal, while the anterior portions are deflected abruptly downward. The outline as a whole is rhombohedral with the distal end squarish and truncated. The largest specimen (No. 19018/6), which shows only one valve, is approximately 21–22 mm. long and 10 mm. wide (Fig. 12).

The nepionic aptychus (specimen No. 19018/8) is nearly flat, showing only a slight anterior convexity. One of the plates is 3.5 mm. long and 1.8 mm. wide. Thirteen fine, concentric, continuous lamellæ could be counted, although at that early stage they appeared merely as growth-lines, the lamellar character not being visible on the surface (Fig. 14).

The interior concave side of the aptychus is covered by minute, concentric growth-lines. The middle shell layer is thin near the apex but increases posteriorly. The thickest part of the shell is at the margin on the line of the posterior ridge.

NUMBER OF SPECIMENS.—Holotype and seven paratypes.

ASSOCIATED SPECIES.—*A. cristobalensis*, new species, at locality No. S. C. 2.

LOCALITIES.—On Finca of Rafael Begoa, 9 miles north of San Cristobal (locality No. S. C. 2) five specimens, Nos. 19018/1–5; on Finca of Rafael Begoa (locality No. S. C. 4) 3 specimens, Nos. 19018/6–8.

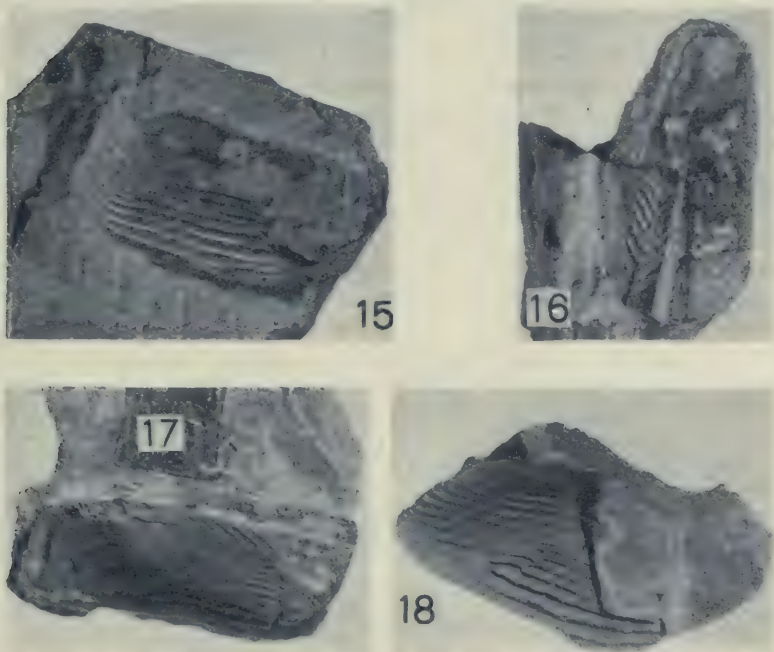
Comparisons.—The distinguishing characteristics of *A. cubanensis* are the angle of curvature of the lamellæ along the posterior ridge and their abrupt, right-angled termination at the external line of junction. These features readily differentiate it from *A. cristobalensis* and *A. pimientensis*, which are found associated with it. The thickening of the lamellæ into folds as they reach the external line of junction is also characteristic. This species appears to be almost identical with the aptychus of *Haploceras* figured by Steinmann (1907, fig. 542) from the Neocomian of Chalançon, Département of Drôme, France, (Fig. 6) except that the Cuban specimens are smaller and they are narrower when viewed from the side. The lamellæ wedge into each other on the side of the valve, while in the French species they are simple and continuous. *Aptychus cubanensis* evidently belongs to a species of *Haploceras*.

***Aptychus pimientensis*, new species**

Figures 15 to 18

DESCRIPTION OF THE HOLOTYPE (Amer. Mus. No. 19019 1). This species is small, rhombohedral in outline and with delicately etched surface features. The measurements for one valve are: length 19 mm., width 10.2 mm., length of the truncated proximal end 8.2 mm (Fig. 15).

The lamellæ are fine and close-set; they increase regularly in size and, beyond the apical portion which is broken away, 26 can be counted. The largest ones wedge out against the smooth peripheral band. There is a pronounced radial ridge on the posterior slope; on the posterior side of the ridge the lamellæ turn sharply toward the apex at an acute angle of about 30° . The junction surface is smooth, triangular, with a maximum width of 1.7 mm.; it is at right angles to the convex surface of the shell. The surfaces of all the lamellæ are finely punctate but this character is most clearly visible on the peripheral surface at the thickest part of the shell.



Figs. 15 to 18. *Aptychus pimientensis*, new species.

Fig. 15. Exterior of valve. $\times 2$. Holotype, A. M. N. H. No. 19019/1.

Fig. 16. Exterior of both valves in juxtaposition, showing triangular junction planes and posterior angulation of lamellæ. $\times 2$. Paratype, A. M. N. H. No. 19019/3.

Fig. 17. Side view of crushed specimen showing acute angulation of lamellæ. $\times 2$. Paratype, A. M. N. H. No. 19019/4.

Fig. 18. View of posterior end of one valve, showing costæ wedging out against peripheral margin and also along the side, producing characteristic *en echelon* notching. $\times 2$. Paratype, A. M. N. H. No. 19019/5.

DESCRIPTION OF PARATYPES.—Specimen No. 19019/4, which is crushed, shows the sharp angulation of the lamellæ on the posterior slope (Fig. 17). Specimen No. 19019/3 shows the two valves in contact along the junction line (Fig. 16). Specimen No. 19019/5 shows the notching of the lamellæ on the anterior slope of the ridge (Fig. 18).

NUMBER OF SPECIMENS.—Holotype and 4 paratypes.

ASSOCIATED SPECIES.—*Aptychus cristobalensis*, new species, at locality No. S. C. 3.

LOCALITIES.—Mt. Pimiento, 5 miles north of San Cristobal, Province of Pinar del Rio (locality No. S. C. 5), three specimens, Nos. 19019/1-3; northeast of Mt. Pimiento in Rio Hondo, 7 miles northeast of San Cristobal (locality No. S. C. 3), two specimens, Nos. 19019/4, 5.

Comparisons.—The most noticeable characteristic of this species is the inflection of the lamellæ at an acute angle as they approach the junction margin. This feature serves as a ready means of distinguishing *A. pimientensis* from *A. cristobalensis* in which the lamellæ are curved, not angular in their inflection. There are also more minute differences: *A. pimientensis* is relatively longer than *A. cristobalensis*, has more even and regular lamellæ, and is rhombohedral instead of semi-elliptical in shape. This species, like the others from the same beds, bears a general resemblance to *A. didayi* from which it differs primarily in shape, being rhombohedral instead of triangular, and having finer, more numerous lamellæ. It probably belongs to a species of *Oppelia*.

BIBLIOGRAPHY OF SOME OF THE MORE IMPORTANT LITERATURE ON THE GENUS *APTYPCHUS*

1811. PARKINSON, JAMES. 'Organic Remains of a Former World.' 3 vols; III, pp. 184-187. (Genus *Trigonellites* (= *Aptychus*) described p. 186; *T. lata*, p. 186, Pl. XIII, figs. 9, 12; *T. lamellosa*, p. 186, Pl. XIII, figs. 10, 11. By the strict rules of priority the name *Trigonellites* should now be used instead of *Aptychus*, but the latter name is firmly rooted in the literature and there is the further consideration that Parkinson considered the opercula to be pelecypods and the name *Trigonellites* is etymologically more appropriate for pelecypods than ammonites.)
- 1830-33. ZIETEN, C. H. 'Die Versteinerungen Württembergs.' (Good illustrations of *Aptychus lævis latus* Meyer (p. 49), Pl. xxxvii, figs. 6 and 7, showing exterior and interior and plates *in situ*.)
1831. MEYER, HERMANN VON. 'Das Genus *Aptychus*.' Nova Acta, XV, pp. 125-170. (Original description of *A. lævis*, p. 128, Pls. LVIII, LIX, figs. 6-9; *A. imbricatus*, p. 139, Pl. LIX, figs. 10-12. Structure of shell, Pl. LIX, fig. 13. Aptychi from the Lias, Pl. LX, figs. 1-7. Aptychi regarded as the shells of mollusks devoured by ammonites, p. 156.)
1837. VOLTZ, PHILIPPE LOUIS. 'Erste Notiz über das Genus *Aptychus*.' Neues Jahrb., pp. 304-312. (General resumé of opinions concerning the nature of aptychi. Voltz considered them to be ammonite opercula.)
1837. 'Zweiter Vortrag über das Genus *Aptychus*.' Neues Jahrb., pp. 432-438. (Classification of 25 species of *Aptychus*, 12 new, into *Cornei*, *Imbricati*, and *Cellulosi*. List of ammonite genera with which aptychi are found *in situ*.)
1841. COQUAND, HENRI. 'Mémoire sur les *Aptychus*.' Bull. Soc. Geol. France, (1) XII, pp. 376-391, Pl. ix. (Summary of previous opinions on the significance of *Aptychus* (pp. 376-386). Considered by Coquand to be genus intermediate between *Loligo* and *Sepia* (p. 387); protographs and

protologs (pp. 387-390): *A. blainvillei*, p. 387, Pl. IX, figs. 8, 9; *A. beaumonti*, p. 388, Pl. IX, fig. 12; *A. radians*, p. 389, Pl. IX, figs. 11 and 11 bis; *A. didayi*, p. 389, Pl. IX, fig. 10; *A. seranonis*, p. 390, Pl. IX, fig. 13. List of 33 species of *Aptychus* classified and with geological horizon, pp. 390, 391.)

1841. GLOCKER, E. F. 'Ueber den Jurakalk von Kurowitz in Mähren und über den darin vorkommenden *Aptychus imbricatus*.' Nova Acta, XXIX, Suppl. 2, pp. 275-308, Pls. I-III. (Mode of occurrence of *Aptychus imbricatus* in the Jurassic of Kurowitz, pp. 285, 286, 289. Detailed description of examples of this species and of the character of the shell layers, pp. 293-306, Pl. III, figs. 1-7, 9. The species here described is synonymous with *A. punctatus* Voltz and is a typical example of the group of the Punctati.)
1846. GEINITZ, H. B. 'Grundriss der Versteinerungskunde.' (Aptychi discussed pp. 307-310; five species (not new) described.)
1849. QUENSTEDT, F. A. 'Die Cephalopoden.' (Very full descriptions of numerous previously known species, pp. 306-323. Protolog of *A. crassicauda*, p. 314, photograph, Pl. XXII, fig. 25. Of especial interest is description of *A. didayi* Coquand, p. 314, Pl. XXII, fig. 21.)
1854. PETERS, K. 'Die Aptychen der österreichischen Neocomien und oberen Juraschichten.' Jahrb. d. k. k. g. Reichsanstalt, V, pp. 439-444. (Protologs of: *A. angulocostatus*, *A. undatocostatus*, *A. lineatus*, *A. pusillus* (p. 441); *A. rectecostatus*, *A. reflexus* (p. 442); *A. aplanatus*, *A. giganteus* (p. 443). Occurrence of *A. didayi* Coquand in the Neocomian noted (p. 441). *A. latus* Voltz (p. 443), *A. depressus* Voltz and *A. profundus* Voltz (p. 444) reported from the Upper Jurassic of St. Veit and Lainz, Austria.)
1854. PICTET, F.-J. 'Traité de Paléontologie,' 2nd edit. II. (Numerous previously described species listed (p. 558), some figured Pl. XLVII, figs. 10-17. Excellent illustration of *A. didayi* Coquand, Pl. XLVII, fig. 17.)
1854. HÉBERT, E. 'Tableau des Fossiles de la Craie de Meudon.' Mém. Soc. Geol. France, (2) V, pp. 345-374. (Original descriptions of three new species of *Aptychus* from the Chalk of Meudon: *A. insignis*, p. 367, Pl. XXVIII, fig. 6; *A. obtusus*, p. 367, Pl. XXVIII, fig. 7; *A. crassus*, p. 368, Pl. XXVIII, fig. 8.)
1856. SHARPE, D. 'Description of the Fossil Remains of Mollusca found in the Chalk of England.' Pt. III, Cephalopoda. (Aptychi of the Chalk (pp. 53-58). New species described: *A. portlocki*, p. 56, Pl. XXIV, figs. 2, 3, 4, (6?); *A. gollevillensis*, p. 56, Pl. XXIV, fig. 5; *A. icenicus*, p. 57, Pl. XXIV, fig. 7a, b; *A. rugosus*, p. 57, Pl. XXIV, figs. 8a, b, and 9; *A. peramplus*, p. 58, Pl. XXIV, fig. 10.)
1858. QUENSTEDT, F. A. 'Der Jura.' (Illustrations and descriptions of a number of previously described species.)
1863. OPPEL, ALBERT. 'Ueber jurassische Cephalopoden.' Pal. Mitth. III. (Protographs and protologs of many species of aptychi found *in situ* in ammonites from the Lithographic Limestone of Solnhofen. *Ammonites lithographicus*, p. 248, Pl. LXVIII, figs. 1-3; *A. thoro*, p. 250, Pl. LXVIII, figs. 6, 7; *A. steraspis*, p. 251, Pl. LXIX; *A. bous*, p. 252, Pl. LXX, fig. 1;

- A. euglyptus*, p. 253, Pl. LXX, figs. 1-5; *A. hybonotus*, p. 254, Pl. LXXI, figs. 1-3; *A. autharis*, p. 255, Pl. LXXI, figs. 4-6; *A. latus*, p. 256, Pl. LXXII, fig. 1; *A. pipini*, p. 257, Pl. LXXII, fig. 3; *A. aporus*, p. 258, Pl. LXXIII, figs. 1-3; *A. hoplisus*, p. 259, Pl. LXXIII, figs. 4, 5; *Aptychus* sp., p. 261, Pl. LXXIV, figs. 3, 4. The Solnhofen beds contain the largest Upper Jurassic *Aptychus* fauna so far known.)
1865. SCHAUROTH, CARL VON. 'Verzeichniss der Versteinerungen in Herzogl. Naturalien Cabinet zu Coburg.' (Protologs and protographs of: *A. punctatus*, p. 152, Pl. iv, fig. 13; *A. exsculptus*, p. 153, Pl. iv, fig. 14. Occurrences given for *A. latus* Münster and *A. lamellosus* Münster, p. 152.)
1866. BENECKE, E. W. 'Ueber Trias und Jura in den Südalpen.' Geogn.-Pal. Beiträge, I, pp. 1-204. (*A. cf. lamellosus* Voltz and *A. cf. latus* Münster reported in *Acanthicus* beds, p. 185, *A. curvatus* Giebel, *A. cf. gigantis* Quenstedt reported from Diphyakalk (p. 192). *A. didayi* recorded as characteristic of the Biancone (Neocomian) formation, p. 135.)
1866. OPPEL, ALBERT. 'Ueber die Zone des *Ammonites transversarius*.' Geogn.-Pal. Beiträge I, Heft 2, pp. 207-316. (References to the occurrence of aptychi species, pp. 218, 234, 252, 279. Occurrence of *Aptychus didayi* in Neocomian of Algeria, p. 273.)
1867. WAAGEN, WILHELM. 'Ueber die Ansatzstelle der Haftmuskeln beim Nautilus und den Ammoniden.' Palæontographica, XVII, pp. 185-210, Pls. XXXIX and XL. (Discussion of the position of the aptychus in the body chamber of ammonites, pp. 192, 193; illustrations on Pl. XL.)
1868. ZITTEL, KARL A. 'Die Cephalopoden der Stramberger Schichten.' (Discussion of characters of *Aptychus*, pp. 49-52; description of Stramberg species (pp. 52-55); *A. punctatus* Voltz, p. 52, Pl. I, figs. 15a, b; *A. beyrichi* Oppel, p. 54, Pl. I, figs. 16-19.)
1868. PICTET, F.-J. 'Mélanges Paléontologiques. IV. Fossiles de la Porte-de-France,' (*A. latus* Voltz) p. 283, Pl. XLIII, figs. 1-4) and *A. imbricatus* Meyer (p. 285, Pl. XLIII, figs. 5-10) described from the Limestone of Porte-de-France.)
1870. ZITTEL, KARL A. 'Die Fauna der Aeltern Cephalopenführenden Tithonbildungen.' (*A. punctatus* Voltz (p. 31), *A. beyrichi* Oppel (p. 32), and *A. exsculptus* Schaubroth (p. 32, Pl. I, fig. 10) and Cellulosi of the *latus* type (pp. 88, 89) described from the Tithonian of the Alps.)
1875. FAVRE, ERNEST. 'Fossiles du Terrain Jurassique de la Montagne des Voirons.' Mém. Soc. Pal. Suisse, II, pp. 1-78. Pls. I-VII. (Four previously known species identified in formations ranging from *Transversarium* through *Acanthicus* zones: *A. latus* (Parkinson), p. 47, Pl. VII, figs. 1-3; *A. punctatus* Voltz, p. 49, Pl. VII, figs. 4, 5; *A. sparsilamellosus* Gümbel, p. 50, Pl. VII, figs. 6-9; *A. beyrichi* Oppel, p. 52, Pl. VII, figs. 10, 11.)
1881. LORIOU, P. DE. 'La Zone à *Ammonites tenuilobatus* D'Oberbuchsitten.' Idem, VII, pp. 1-60, Pls. I-X. (Presence of *Imbricati* recorded, p. 27, Pl. VII, figs. 6, 7, and *Cellulosi*, p. 27, Pl. VII, figs. 8, 9, no species described.)
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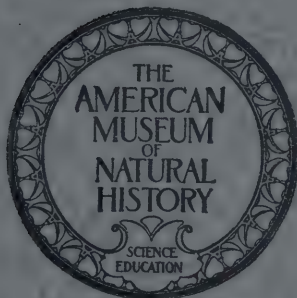
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1891. RETOWSKI, O. 'Die Aptychen sind echte Ammonitendeckel.' Neues Jahrb., Jahrgang 1891, II, pp. 220-221 and text figure. (Description and illustration of *A. beyrichi* Oppel shown *in situ* in the aperture of *Haploceras elimatum* (Oppel).)
1893. RETOWSKI, O. 'Die tithonischen Ablagerungen von Theodosia.' Bull. Soc. Imp. des Nat. Mosc., N. S., VII, pp. 206-301, Pls. ix-xiv. (*A. punctatus* Voltz reported to be very abundant in Tithonian of Theodosia in the Crimea (p. 225); *A. beyrichi* Oppel described as *A. elimati* because found *in situ* in *Haploceras elimatum* (p. 226); *A. cf. exsculptus* Schau- roth rare, p. 227, Pl. ix, fig. 2.)
1893. CHOFFAT, PAUL. 'Faune Jurassique du Portugal.' (No species described. Rare occurrence of aptychi fragments in limestones of Cabaço series noted; Cellulose of the *latus* type frequent in the marl beds of the Monte- junto and Abadia series of Portugal.)
1894. MICHAEL, RICHARD. 'Ammoniten Brut mit Aptychen in der Wohnkammer von *Oppelia steraspis* Oppel sp.' Zeit. d. deutsch. geol. Gesellschaft, XLVI, pp. 697-702, Pl. LIV. (Contains description of embryonic am- monites found in body chamber of *Oppelia steraspis*, both the young and mature shells having aptychi.)
1896. BLACKMORE, H. P. 'Some notes on the Aptychi from the Upper Chalk.' Geol. Mag., N. S., (4) III, pp. 529-533, Pl. xvi. (Paper deals with Upper Cretaceous aptychi only and they are considered to be opercula of belemnites. *A. rugosus*, p. 532, Pl. xvi, fig. 16, shows form very similar to Cuban species.)
1898. CRICK, G. C. 'Fossil Cephalopoda in the British Museum.' (Four Upper Cretaceous (Upper Chalk) species of *Aptychus* listed (pp. 32, 33). All previously described by Sharpe, *q. v.*)
1899. PAUL, C. M. 'Der Wienerwald. Ein Beitrag zur Kenntniss der nordalpinen Flyschbildungen.' Jahrbuch der k. k. geol. Reichsanstalt, XLVIII, pp. 53-178, Pl. I-VI, 26 text figures. (The species of *Aptychus* occurring in the Wienersandstein are recorded on pp. 58, 59, 60, 135, 141, 142, 152, 158, 175.)
1905. VETTERS, HERMANN. 'Die Fauna der Juraklippen zwischen Donau und Thaya.' Beiträge zur Paläontologie und Geologie Österreich-Ungarns und des Orients, XVII, pp. 223-259, Pls. xxi, xxii. (Occurrence of *Aptychus punctatus* Voltz, p. 242, Pl. xxi, fig. 4, and *A. latus* Meyer, p. 243, in the Niederfellabrunn Tithonian noted.)
1907. TOULA, FRANZ. 'Die Acanthicus-Schichten im Randgebirge der Wiener Bucht bei Giesshübl.' Abh. d. k. k. geol. Reichsanstalt, XVI, Heft 2 (Aptychi of *Acanthicus* beds, pp. 80-82, 88. Original description of: *A. celluloso- salammellosus*, p. 80, Pl. xviii, fig. 4; *A. insolidus*, p. 81, Pl. x, fig. 2. Occurrence of *A. cf. didayi* Coquand noted, p. 88, Pl. xii, fig. 6.)
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FIVE NEW SPECIES OF SALIENTIA FROM SOUTH AMERICA

By G. K. NOBLE



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FIVE NEW SPECIES OF SALIENTIA FROM SOUTH AMERICA

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Among the collections of amphibians from South America which have been acquired in recent years by The American Museum of Natural History, there are included several interesting new forms. Perhaps the most remarkable of these is one which must be referred to the genus *Sminthillus*, although zoogeographic considerations make it seem highly probable that the form described below has been derived from a different stock from that which gave rise to *S. limbatus*, the type, and, until this time, sole member of the genus. *S. limbatus* is confined to Cuba while the species described here is restricted to a limited region in southern Peru. *Sminthillus* has been only recently defined (Barbour and Noble, 1920, Bull. Mus. Comp. Zool., LXIII, p. 402). I have more recently added certain details in regard to the structure of the shoulder girdle (Noble, in press). These structural details are very important from a phylogenetic viewpoint. But, as I have discussed these features at considerable length in the latter paper, I shall not enter into them here.

The genus *Atelopus* is much in need of revision. A number of diverse stocks have been lumped together under the name *A. ignescens*. Until the limits of specific variability have been determined for several more forms, it is impossible to discuss the status of these stocks or the relations of a number of the described species. The characters which I have utilized below appear at this time to be diagnostic.

Sminthillus peruvianus, new species

DIAGNOSIS.—Readily distinguished from the *S. limbatus* by its blunter snout, less vertical loreal region, by the presence of a tarsal tubercle, longer tibia and different coloration; from the disk-less species of *Syrrhopus*, it may be distinguished externally by the more vertical loreal region and stouter form.

RANGE.—Known only from the present series secured near Juliaca, Peru, by H. H. Keays, (no date).

TYPE.—A. M. N. H. No. 14526; from the same locality.

DESCRIPTION OF TYPE.—Snout rounded, equal to the greatest diameter of the orbit; loreal region abrupt, nearly vertical; nostril midway between the tip of the snout and the anterior corner of the eye; interorbital space a little broader than the upper eyelid; horizontal diameter of the tympanum about one-half, vertical diameter nearly

two-thirds the greatest width of the eye; tympanum about one-half its smallest diameter from the latter. Digits pointed, no terminal disks; a well-developed tarsal and two metatarsal tubercles. Tibio-tarsal articulation reaching just beyond the posterior angle of the eye; when the limbs are held vertical to the axis of the body, the tibio-tarsal articulation overlapping its mate of the opposite side. Skin feebly granular above, smooth below.



Fig. 1. *Sminthillus peruvianus*, new species. Type.

Fig. 2. *Sminthillus peruvianus*, new species. Paratype, showing color variation.

Color uniform grayish brown, slightly purplish above; a broad band of dark brown extending on each side from the nostril to the lumbar region; a narrow white line on the posterior face of each thigh joining with a median line which extends anteriorly along the back for more than half its length; posterior surfaces of the lower leg indistinctly barred with dark brown. Lower surfaces of body whitish, the chin and thigh indistinctly suffused with brown.

Dimensions

Snout to vent.....	16 mm.
Greatest width of head.....	5 mm.
Axilla to tip of longest digit.....	8 mm.
Groin to tip of longest toe.....	21.5 mm.

NOTES ON PARATYPES.—Four specimens in addition to the type are included in the series. These differ greatly in color and slightly in proportions. The two extreme types of coloration are shown in Figures 1 and 2. In the paratype figured, the ground tone is a pale yellowish brown. A sharply defined pattern is formed by blotches of dark brown. The two inguinal spots are nearly black. The ventral surface is uniformly suffused with a reddish brown which is darker on the throat than on the thighs. The other three paratypes exhibit stages of intergradation between the coloration of the paratype figured and that of the type specimen. Their browns are

redder than in the type and one has a broad hour-glass shaped pattern of dark reddish brown dorsally. The paratypes exhibit some variation in leg length. In all, the hind limb is longer than in the type.

***Atelopus bicolor*, new species**

DIAGNOSIS.—A large species, closely allied to *A. Boulengeri* Peracca, but differing in the webless digits of the manus and the shorter webs of the toes, also in the different proportions, shorter leg and shorter snout. Skin smooth; first toe distinct; tibio-tarsal articulation not reaching eye; generally dark brown above, yellow below, irregularly marked on the sides.

RANGE.—Known only from the type locality.

TYPE.—A. M. N. H. No. 13132; from Cordillera Kutuku (1800–2000 meters), east of Macas, Ecuador; collected by E. Feyer; 1921.

DESCRIPTION OF TYPE (Adult male).—Head a trifle wider than long, its length (tip of snout to angle of jaw) contained three and a half times in head and body length; distance from the eye to the end of the snout one-third greater than the longest diameter of the eye; nostril much nearer the end of the snout than the eye; snout projecting only a little beyond mouth; interorbital space 1.3 or 1.2 times the width of the upper eyelid. Anterior limb stout; distance from axilla to tip of longest digit equals the body length; no webbing between the digits of the manus although the skin between the first and second digits is thick; first digit much shorter than the fourth. Tibio-tarsal articulation nearly reaching the eye; toes webbed to the tips (except the fourth), but the web deeply indented, making the toes appear half webbed; a single metatarsal tubercle; subarticular tubercles feeble. Skin smooth above and below; a number of feeble transverse furrows on the ventral surface.

Color above dark reddish brown; below and on the sides yellow; an irregular dark streak on the sides of the abdomen; yellow of the sides encroaching upon the periphery of the dorsal ground tone, forming a symmetrical yellow margin to the dorsal coloration; limbs broadly crossbarred with yellow; ventral surface of the head and body immaculate; a few dark crossbars on the legs.

Dimensions

Snout to vent.....	51 mm.
Greatest width of head.....	15.5 mm.
Axilla to tip of longest digit.....	37 mm.
Groin to tip of longest toe.....	68 mm.

NOTES ON PARATYPES.—Three specimens in addition to the male were collected. Two are males and the third is an immature specimen. They vary considerably in coloration but agree in having the ventral surface yellow and immaculate, the dorsal surface dark brown or reddish with no markings except an irregular border of yellow.

***Atelopus rugulosus*, new species**

DIAGNOSIS.—Very similar to *A. tricolor* Boulenger, from which it differs in the warty upper surfaces, somewhat different proportions and absence of "flash colors." Inner toe rudimentary; tibio-tarsal articulation extending beyond the eye; inter-orbital space twice as broad as the upper eyelid.



Fig. 3. *Atelopus rugulosus*, new species. Type.

Fig. 4. *Atelopus bicolor*, new species. Type.

Fig. 5. *Phyllobates anthonyi*, new species. Type.

Fig. 6. *Telmatobius cinereus*, new species. Type. Ventral surface of left foot.

RANGE.—Known only from the type locality.

TYPE.—A. M. N. H. No. 6097; vicinity of Juliaca, Peru; H. H. Keays.

DESCRIPTION OF TYPE (Adult male).—Distance from the angle of the jaw to the tip of snout one-fifth wider than the greatest width of the head, exactly three times as great as the head and body length; snout prominent, overhanging the mouth for a distance equal to the greatest diameter of the eye; nostril nearer the tip of the snout than the eye; interorbital space twice as broad as the upper eyelid. Fingers webbed slightly at the base, first very short; toes entirely webbed, but the web between the third and fourth, and the fourth and fifth digits notched; first toe rudimentary, enclosed within the web; no metatarsal or subarticular tubercles. Tibio-tarsal articulation reaches nearer the tip of the snout than the eye. Skin covered with flat warts above, smooth below, except for the throat which is somewhat granular.

Dark brown above spotted with yellow, a broad streak of yellow on each side of the back from eye to groin; upper lip yellow, and a series of yellow spots on the sides of the body; ventral surfaces yellow with a few dark spots on the belly; a tinge of pink on the thighs near their proximal end, but no axillary or inguinal spots of the same color.

Dimensions

Snout to vent.....	22 mm.
Greatest width of head.....	6.8 mm.
Axilla to tip of longest digit.....	14.5 mm.
Groin to tip of longest toe.....	30 mm.

NOTES ON PARATYPE.—Only two specimens, both males, of this species were secured. The paratype differs from the type in being more spinose, the tubercles being pointed, not flat as in the type. The coloration is essentially the same in both specimens, but the paratype is nearly immaculate below.

Phyllobates anthonyi,¹ new species

DIAGNOSIS.—Similar to *P. tricolor* (Boulenger), but readily distinguishable by its longer leg, longer first finger, longer snout, and different coloration. The color pattern is somewhat similar to that of *P. tricolor* but the flash colors are lacking and the stripes are bluish not yellowish.

RANGE.—Known only from the type locality.

TYPE.—A. M. N. H. No. 13739; from a small stream at Salvias, Prov. del Oro, Ecuador; collected August 10, 1920, by H. E. Anthony.

DESCRIPTION OF TYPE.—Snout depressed, a little longer than the greatest diameter of the eye; nostril much nearer the end of the snout than the eye; loreal region vertical; interorbital space 1.4 times as broad as the upper eyelid; tympanum a little more than half as long as the greatest diameter of the eye, edged above by a prominent supratympanic fold. Disks of the digits small, much smaller than the tympanum; first finger slightly longer than the second; two metatarsal tubercles, the inner prominent; a well-developed tarsal tubercle; tibio-tarsal articulation reaching the anterior corner of the eye. Skin smooth above and on the sides.

¹Named for Mr. H. E. Anthony, Associate Curator of Mammals of the Western Hemisphere in The American Museum of Natural History, and collector of the type series.

Ground tone above dark chestnut brown; a broad medial stripe and two dorsolateral ones of pale bluish gray, the medial stripe widening anteriorly to form the major coloration of the snout, and restricting the ground tone in this region to a number of spots. Ground tone of the sides a little darker than that of the back; in addition to the dorsolateral stripe, a ventrolateral one of the same color; the latter forming anteriorly a prominent stripe on the upper lip, while the former passes along the outer edge of the eyelid and merges into the light tone of the snout. Thighs cross-barred with pale gray; concealed portion of the thigh blotched with white which may have been yellowish in life. Ventral surface white or slightly tinged with yellow and heavily marbled with dark brown, the marbling most pronounced about the periphery of the ventral surface; no dark bands on the chest or throat.

Dimensions

Snout to vent.....	21 mm.
Greatest width of the head.....	6.5 mm.
Axilla to tip of longest digit.....	14 mm.
Groin to tip of longest toe.....	30 mm.

NOTES ON PARATYPE.—A single paratype was secured. It differs from the type in having the lateral stripes more whitish and in having the ventral surface marbled with brown on the periphery only.

Telmatobius cinereus, new species

DIAGNOSIS.—Very similar to *T. niger* Barbour and Noble, from which it differs chiefly in the narrower webbing of the toes (compare Figure 6 with Fig. 1, Barbour and Noble, 1920, Bull. Mus. Comp. Zool., LXIII, p. 414), the narrower interorbital space, the absence of a ventral disk, and the grayish, not chestnut, coloration.

RANGE.—Known only from Bestion, Ecuador, the type locality.

TYPE.—A. M. N. H. No. 13968; from Bestion, Ecuador, caught in a mouse-trap set among low bushes and grass; January 7, 1921, by H. E. Anthony.

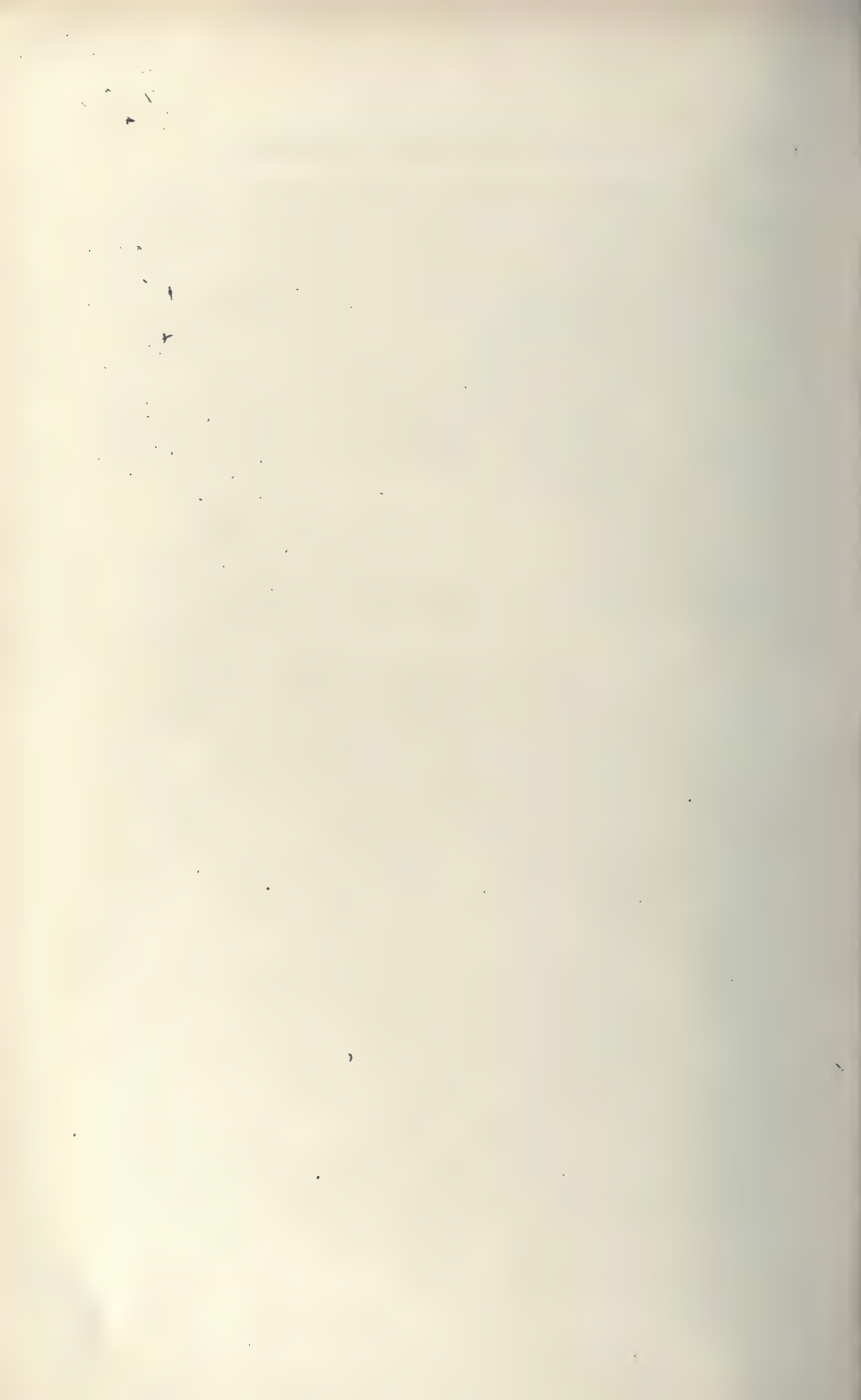
DESCRIPTION OF TYPE.—Size moderate; head much broader than long, narrower than the body, its length contained in the total length of the body a trifle more than three times; snout very short and high without canthus rostralis; nostril nearer the orbit than the labial border. Vomerine teeth prominent in two well-defined groups between the choanae; tongue about as long as broad. Interorbital space exactly as long as the diameter of the eye; length of the snout 1.4 times that of the eye; tympanum hidden; a prominent supratympanic fold. Digits free, stout, not dilated at the tips, the first finger longer than the second, a trifle longer than the fourth; the elbow extended forward reaches nearly to the eye. Toes a trifle less than half webbed, but narrow seams extending to the bases of the terminal phalanges; a well-defined tarsal fold; subarticular tubercles well developed; two metatarsal tubercles of about the same size; heels just in contact when the hind limbs are folded at right angles to the axis of the body; tibio-tarsal articulation reaching to the middle of the orbit or slightly beyond. Skin very glandular above, but not warty; no baggy lateral fold; a few irregular folds on each side of the body; no ventral disk, the skin of the abdomen not marked off from the lateral regions; a slight indication of a pectoral fold formed by a small fold on each side immediately posterior to the humerus; posterior surfaces of the thighs not folded or baggy.

Color above lead gray; ventral surface pinkish, heavily blotched and mottled with dark brown, the spots most abundant on the throat, least on the thighs.

Dimensions

Tip of snout to vent.....	62 mm.
Tip of snout to angle of jaw.....	20 mm.
Greatest width of head.....	24.5 mm.
Axilla to tip of longest digit.....	36 mm.
Groin to tip of longest toe.....	88 mm.

The species is known only from the type specimen. As might be expected from its distribution, the species is intermediate between *T. niger* Barbour and Noble and *T. ignavus* Barbour and Noble, but more closely related to the former.

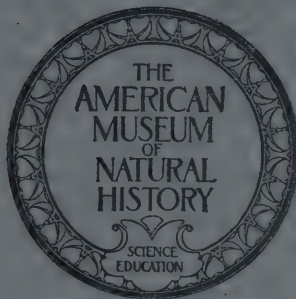


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No. 30

THE DISTRIBUTION OF THE SWALLOWS OF THE GENUS *PYGOCHELIDON*

BY FRANK M. CHAPMAN



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THE DISTRIBUTION OF THE SWALLOWS OF THE GENUS *PYGOCHELIDON*

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Continued study of our recently acquired collections of South American birds reveals certain facts in regard to the distribution of the blue and white swallows of the genus *Pygochelidon* which seem worthy of independent record.

The range of this genus extends from Costa Rica to Tierra del Fuego. It contains four known forms (of which two are herein described for the first time), the general characteristics and distribution of which are set forth below, following which I present some remarks and conclusions.

I am indebted to Dr. Alexander Wetmore, of the Biological Survey, and Mr. James L. Peters, of the Museum of Comparative Zoology, for information in regard to the distribution of *P. cyanoaleuca* and *P. patagonica patagonica* based on their recent explorations in southern South America.

Pygochelidon cyanoaleuca (Vieillot)

Hirundo cyanoaleuca VIEILLOT, 1817, *Nouv. Dict. d'Hist. Nat.*, XIV, p. 509 (Paraguay. One Paraguay specimen examined).

Hirundo minuta MAX., 1821, 'Reise Bras.', II, p. 336 (Rio Janeiro, Brazil. Types and freshly collected material examined).

H[irundo] melampyga LICHT., 1823, 'Verz. Doubl.', p. 57 (Bahia, Brazil. Bahia specimen examined).

Atticora cyanoaleuca var. *montana* BAIRD, 1865, 'Rev. Am. Bds.', p. 310 (Barranca, Costa Rica. Costa Rica specimens examined).

SPECIFIC CHARACTERS.—Sexes alike in color, tail in the male averaging longer. Adult with rectrices and remiges and their shafts, black or blackish; outer margin of outer rectrix never lighter than the rest of the feather; under wing-coverts and axillars fuscous to chætura-drab; lower tail-coverts wholly black with steel-blue reflections; median area of the feathers of the nuchal region whitish (a character more pronounced in northern than in southern specimens); underparts (except sides and flanks) pure white; back varying from a deep indigo-blue to a greenish blue, the variation partly individual, partly seasonal and apparently occurring throughout the range of the species. For example, a Boruca, Costa Rica, male taken May 10 is blue while a San José male taken April 1 is green. Both blue and green birds were

taken at San Antonio, western Colombia, in January; while of nineteen Bolivian tableland birds twelve, taken in May, June, and July, are green and seven, taken in November, December, and February, are blue.

Immature birds have the wings and tail fuscous, the lower tail-coverts dusky, more or less tipped with grayish, a trace of cinnamon may suffuse the white underparts, but the lower wing-coverts are as in the adult and the outer tail-feather is uniformly colored, the outer margin NEVER being paler than the rest of the feather.

SIZE.—There appears to be no marked latitudinal variation in size among birds from apparently the same altitude. Specimens from near sea-level in Ecuador (Rio de Oro) are the smallest in the series while specimens from the Ecuadorian tableland are larger and near the average size. The tail apparently averages longer in the male, but there is much variation in this respect.

Although recorded from Costa Rica to Paraguay¹ and from western Ecuador to eastern Brazil, *Pygochelidon cyanoleuca* is a bird of the Subtropical, rather than the Tropical, Zone and is restricted largely to mountainous regions. In Costa Rica, Carriker does not record it from a lower altitude than 1000 feet, whence it ranges upward to the Irazu district. It is recorded by Bangs from Chiriqui, western Panama, at an altitude of 10,800 feet, and from "Veragua" by Salvin and Godman. Sharpe and Wyatt ('Mon. Hirund.') state that Salvin and Godman's collection contains three specimens secured by McLeannan in "Panama," presumably south of Colon where this collector worked. There are no Panama specimens in the American Museum, and I know of no other Panama records. In Colombia we found this swallow to be most abundant in the Subtropical Zone, but it ranged from 2000 to 9000 feet. In Ecuador our only record for the coastal region is Rio de Oro, Manaví, whence it ranges upward to the tableland. It has not been found in the Guayaquil region and our most southern Pacific coast region record is Portovelo (alt. 2500 ft.), near Zaruma on the eastern slope of the coast range west of Santa Rosa. It occurs also in eastern Ecuador at Zamora and thence south on eastern, or Amazonian, drainage from Peru (Huanabamba, Perico, La Merced, Perené, Sta. Ana, Torontoy, Santo Domingo) to Bolivia, whence all our specimens are from altitudes of from 7700 to 9400 feet (Depts. Cochabamba, Sucre). In Argentina it extends at least to the Prov. of Tucuman, whence we have a wholly typical adult male taken on the Tafi trail at an altitude of 2000 feet, April 12, 1916.

East of the Andes this swallow appears to be much less common. It is not, for example, recorded from the Orinoco region by Berlepsch

¹Records from Chile are evidently based on erroneous identification or wrongly labeled specimens. For example, a skin labeled by Rusby "Valparaiso" (doubtless the one referred to by Ridgway in Bull. 50, III, p. 70; see also Allen, 1889, Bull. A. M. N. H., II, p. 80) evidently bears an incorrect locality, as unfortunately do some other specimens in this collection.

and Hartert, or from Cayenne by Berlepsch, and Snethlage gives no definite record from Amazonia, though a specimen from Pará is listed in the British Museum 'Catalogue.' Salvin records it in Guiana only from an altitude of 3500 feet on Mt. Roraima, and a single Guiana specimen is listed from Camacusa. In Venezuela and Brazil it appears to be confined largely to the mountainous and coastal areas. It is apparently not uncommon near the coast of extreme southeastern Brazil, and Wetmore secured specimens at Lazcano, in northeastern Uruguay, the most southern record for the species.

From the interior of South America there appear to be only two records for this species. Smith secured one specimen September 10, 1885, at Chapada, Matto Grosso, during nearly five years' collecting, and a specimen in the U. S. National Museum, No. 35040, was secured by C. Wood of the Page Expedition at Bahia Negra, S. lat. 20° on the Paraguay River, in June, 1859.

Cherrie secured no specimens of this species during two expeditions in southwestern Brazil, and it is evidently rare or wanting in the interior of South America, at least north of subtropical latitudes.

In general, then, *Pygochelidon cyanoleuca* is not, as has been often stated, distributed "throughout" South America, but is largely confined to mountainous areas and to the Subtropical Zone. Furthermore, while not a bird of the forest, it occurs chiefly in forested regions.

***Pygochelidon patagonica patagonica* (d'Orbigny and Lafresnaye)**

Hirundo patagonica D'ORBIGNY AND LAFRESNAYE, 1837, 'Syn. Av.,' p. 69 (Patagonia).

Atticora hemipyga BURMEISTER, 1861, 'Reis. La Plata,' II, p. 479 (Mendoza, Argentina; one specimen examined).

SPECIFIC CHARACTERS.—Sexes alike in color (and in size?); rectrices and remiges and greater wing-coverts fuscous, their shafts brownish; outer margin of outer rectrix narrowly but distinctly EDGED WITH WHITISH; under wing-coverts and axillars mouse-gray; shorter lower tail-coverts white, longer ones sometimes (in more southern specimens) basally white; feathers of the nuchal region basally gray; size larger than *cyanoleuca*.

Immature birds have the wings and tail fuscous as in the adult. The under wing-coverts and axillars are also mouse-gray and the outer margin of the outer tail-feathers is edged with grayish. The longer tail-coverts are fuscous, tipped with grayish, the shorter ones white in young birds from Mendoza and Prov. Tucuman (4000 ft.), but in three specimens in a corresponding state of plumage from Tilcara (8000 ft.), Prov. Jujuy (February 8-12), the longer lower tail-coverts are fuscous tipped with cinnamon, the shorter ones cinnamon. I do not know whether this char-

acter represents a racial or individual variation. An adult female taken February 8, at the same locality, has the under tail-coverts wholly black. In other respects all four Tilcara birds are typical *patagonica*.

This is a migratory species. During the summer it is found throughout the South Temperate Zone, south to Tierra del Fuego and north to Peru over the Andes of northwestern Argentina and (presumably) Puna or Temperate Zone in Peru. It winters chiefly north of S. lat. 30° and (presumably) at the eastern base of the Andes as far north as the Marañon.

On the Pacific coast this swallow is doubtless found from Chiloe to near the Peruvian border where it apparently intergrades with the Peruvian race described below. I have, however, seen specimens only from Temuco to Tofo, sixty miles north of Coquimbo, but it is probable that the birds recorded by Lane¹ from east of Iquique should be referred to this race. According to this writer the species ranges upward to 12,000 feet, in which event it doubtless crosses the Andes at this, or even a greater, altitude.

It is found in southern Chile, and doubtless at high altitudes, only during the summer. I have been unable to ascertain the exact limits of its seasonal range in Chile but according to Barros² it is found in the Valley of Nilahue (S. lat. 34° 30') only from the end of August to the middle of March. In Argentina it is rarely found in winter south of the latitude of Buenos Aires and Mendoza.³ On September 10, 1916, I observed it in large numbers near the first-named city, where Dr. Dabbene informed me it had just arrived from the north. The return (postbreeding) migration is concluded by March 15.

Hartert,⁴ in recording the breeding of this swallow in the Prov. of Tucuman (no altitude stated) on the authority of Venturi, mentions also specimens from Cosnipata, Yurimaguas, and Nauta, Peru. Hellmayr⁵ also refers to the Cosnipata birds, of which one is young and four adult, and confirms Hartert's identification of them. They were collected by H. Whitely, Jr., on September 20, October 5 and 7, 1868, after the date, therefore, on which *patagonica* reaches its breeding grounds south of the latitude of Buenos Aires, and are consequently not likely to have been winter visitants from the South Temperate Zone.

¹1897, *Ibis*, p. 15.

²1920, *Revista Chilena Hist. Nat.*, XXIV, p. 147.

³Reed, 1916, 'Las Aves de la Prov. de Mendoza,' *Mus. Ed. Mendoza*, p. 39.

⁴1909, *Nov. Zool.*, XVI, p. 169.

⁵1919, *Arch. für Naturg.*, p. 9.

In traveling from Paucartambo to Cosnipata, Whitely passed over bare treeless regions at an altitude of 11,900 feet. We have seen that *patagonica* reaches an altitude of 12,000 feet on northern Chile and it would not be surprising if, like many other South Temperate Zone birds, it should range north on the Andean Temperate, or Puna Zone, whence, assuming that the specimens in question actually came from Cosnipata (alt. about 2350 ft.), it might occasionally visit the lowlands.

I frankly confess that the records from Yurimaguas and Nauta seemed to me to require confirmation. Both localities are in the Tropical Zone and the latter is some 250 miles east of the Andes, but the discovery in our own collection of a wholly typical adult male in fresh (postnuptial ?) plumage taken November 12, 1919, by H. Watkins at La Merced (alt. 2600 ft.) in the Chanchamayo district of eastern Peru, proves to my complete satisfaction that *patagonica* occurs in this region. I cannot, however, believe that a species so characteristic of the South Temperate Zone breeds in the Tropical Zone and, in spite of the fact that it has never been recorded from the Peruvian highlands, I conclude that records from Cosnipata, La Merced, Yurimaguas, and Nauta are based on birds which breed in the Temperate or Puna Zones and migrate or wander to the lowlands.

So far as I am aware no other swallow of the Temperate or Puna Zone has this habit, but no other swallow of these zones is found also in the South Temperate Zone. Possibly *patagonica* in extending its range northward on the Andean tableland has retained the migratory habit which it displays in the South Temperate Zone.

RELATIONS of *P. patagonica* with *P. cyanoleuca*

Having described the characters which distinguish *cyanoleuca* and *patagonica* from each other and outlined their known ranges the question arises, are they specifically or subspecifically related? In other words, do they or do they not intergrade? While I have no proof that both forms are actually found together during the breeding season, it is evident that in Uruguay, Paraguay, and northern Argentina the limits of their ranges very closely approach, if they do not actually touch, each other.¹ It is also a fact that throughout its wide range *cyanoleuca* shows no appreciable geographic or racial variation, specimens from Uruguay,

¹Until we know the facts in regard to the seasonal distribution of *patagonica* in Peru, we cannot discuss its relationships with *cyanoleuca* in that region.

Paraguay, and northern Argentina, where the species most closely approaches the home of *patagonica*, agreeing with others from Colombia or Costa Rica.

It is further true that, except for a racial differentiation on the coast of Peru and certain variations exhibited by four specimens from Tilcara (8000 ft.) near Tucuman, *patagonica* is everywhere true to type. The Peruvian variation will be returned to later; the Tilcara birds require description here. They were taken February 8-12, 1916. An adult female in worn breeding plumage has the tail, wings, and under wing-coverts wholly black as in *cyanoleuca*. The remaining three specimens are birds of the year in postjuvenile plumage. Like the adult female, their wings, under wing-coverts, and tail are as in *patagonica*, but the longer under tail-coverts are fuscous tipped with cinnamon, while the shorter ones are cinnamon, a character shown by no immature specimen of *cyanoleuca* which I have examined. While the adult specimen might be considered an intermediate between *cyanoleuca* and *patagonica*, the young birds could not properly be so considered. Moreover, an adult and young taken March 12, 1916, above San Pablo (4000 ft.), Prov. Tucuman, are wholly typical of *patagonica*, the young bird having the lower half of the under tail-coverts white. While, therefore, we have an ultratypical adult of *cyanoleuca* taken on the Tafi trail (2000 ft.), Prov. Tucuman, April 12, 1916, it is improbable that intergrades between this species and *cyanoleuca* would be found at the highest of the three localities mentioned.

If those from the intermediate locality were intergrades, the fusion of the two species might be indicated in this region. Under the circumstances, however, I conclude that the variations shown by the Tilcara specimens are either individual or racial, and that they do not indicate the intergradation of *cyanoleuca* with *patagonica*.

It is worthy of note that the variation shown by the west Peruvian bird, described below, is similar to that exhibited by the Tilcara adult, that is, it has wholly black under tail-coverts. In the paleness of the under wing-coverts the Peruvian form is even further removed from *cyanoleuca* than is *patagonica*, and, as shown beyond, it is quite certain that it does not intergrade with that form.

Further evidence of the stability of the characters of *patagonica*, east of the Andes, is shown by the fact that a specimen from La Merced, eastern Peru, agrees closely with others from Argentina.

In view of these facts, I conclude that *cyanoleuca* and *patagonica* do not intergrade and hence are specifically distinct.

***Pygochelidon patagonica peruviana*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Pygochelidon patagonica patagonica* but smaller, the under wing-coverts and axillars paler; the under tail-coverts wholly black with bluish reflections, the lower parts, particularly flanks, tinged with grayish.

TYPE.—No. 152,289, Amer. Mus. Nat. Hist.; ♀ ad.; December 26, 1918; Huaral, Prov. Lima, Peru; H. Watkins.

The *Pygochelidon* of western Peru has heretofore been referred to *cyanoleuca* but proves to be a northern representative of *Pygochelidon patagonica*. Our collection contains forty-four specimens of this race taken from Moquegua in southern Peru, north to Trujillo. Specimens from Arequipa, listed in the 'Catalogue of Birds of the British Museum' under "*Atticora cyanoleuca*," are probably to be referred to this form, but it apparently does not reach the tableland. Although our Peruvian collector, H. Watkins, has sent us specimens of this swallow from nearly every station from Trujillo to Moquegua, it is not included in his large collections from the Payta region and the Peruvian-Ecuadorian boundary. This fact, in connection with Stolzmann's¹ definite statement that the species does not occur at Tumbes, and its absence from Noble's² collections made from Payta eastward, indicates that it is not found in extreme northwestern Peru.

RELATIONS OF *P. p. peruviana* WITH *P. cyanoleuca*.—The possession by *peruviana* of the wholly black under tail-coverts of *cyanoleuca* and the wings and tail of *patagonica* might be accepted as evidence that it was a connectant between these two species. The fact, however, that in *peruviana* the under wing-coverts and axillars are even paler than they are in *patagonica*, shows that in this respect it is less like *cyanoleuca* than *patagonica* itself. Moreover, the probability that the range of *peruviana* does not reach that of *cyanoleuca* further indicates their non-intergradation.

RELATIONS OF *P. p. peruviana* WITH *P. p. patagonica*.—Although I have seen no specimens of either of these races from the region between Tofo, Chile, and Moquegua, Peru, just north of the Chilean line, the species has been recorded from east of Iquique and doubtless occurs at suitable localities between these two points, for example, Tacna and Arica. Tofo specimens are typical of *patagonica*; one from Moquegua is immature, but an adult female of *peruviana* from Cocachacra, on the coast south of Mollendo, shows an approach to *patagonica* in its larger

¹1884, 'Orn. Per.', I, p. 245. In view of Stolzmann's statement that this swallow was replaced at Tumbes by *Progne chalybea*, it is interesting to note that the only specimens of this martin sent us by Watkins are from localities in the Payta district where he did not take *P. p. peruviana*.

²1918, Auk, p. 458.

size (wing, 99 mm.) and the presence of white in the shorter under tail-coverts. The latter character is shown also by a specimen from Pisco, and these two birds indicate, in my opinion, the intergradation of *peruviana* with *patagonica*.

***Pygochelidon flavipes*, new species**

SPECIFIC CHARACTERS.—Resembling *Pygochelidon cyanoleuca* (Vieillot) but the feet yellow and smaller; the upperparts darker; sides and flanks blackish; throat cinnamon-buff, chin dusky.

TYPE.—No. 169,932, Amer. Mus. Nat. Hist.; ♀; April 7, 1921; Maraynioc, 10,850 ft., Prov. Junin, Peru; H. Watkins.

DESCRIPTION OF TYPE.—Upperparts shining, dusky slate-blue; wings and tail blacker, less blue; throat cinnamon-buff, this color tinging the breast, chin dusky; under wing-coverts, axillars, flanks and tibiae fuscous-black; under tail-coverts like wings; tarsi wholly bare, with toes and nails buffy yellow. Wing, 92; tail, 47; tarsus, 9; middle toe without claw, 6.5; depth of tail-fork, 11 mm.

This species differs so widely from any specimens in our large collections of allied forms that I venture to describe it on the basis of but one example. It is apparently an Andean Temperate Zone representative of *Pygochelidon cyanoleuca* and the fact that it comes from Maraynioc, in the humid Temperate Zone of the Eastern Andes of Peru, is a further proof that exceptionally potent forces have prevailed in the zone in which that locality is situated.

The bird's evident relationships with *P. cyanoleuca* make it of interest to note that, like that species, of which specimens were secured only 3000 feet farther down the Valley, it inhabits a wooded region.

If, as seems probable, *P. p. patagonica* occurs at this or a higher altitude in Peru, it doubtless will be found on the treeless areas of the arid Temperate or Puna Zones.

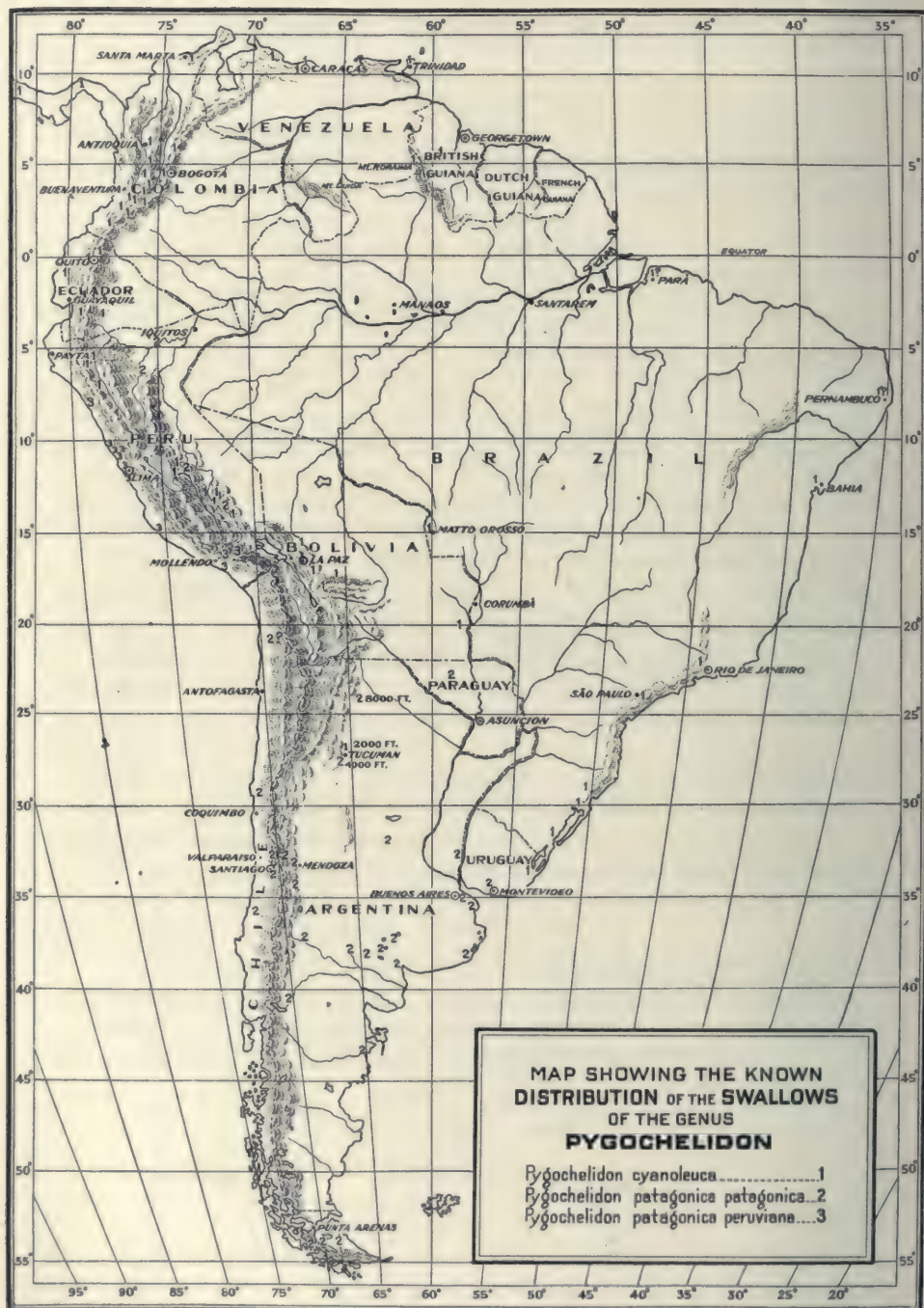
From Maraynioc have been described such distinct generic types as *Doliornis sclateri*, *Xenodacnis parina*, *Pseudospingus xanthophthalmus*, and *Microspingus trifasciatus*, besides a number of species and races all as yet unknown outside the humid Temperate Zone in Peru.

MEASUREMENTS OF MALES

	NUMBER	WING	TAIL
<i>P. cyanoleuca</i> , Costa Rica, Irazu, 9000 ft.	2	95-96.5	51-51.5
" " Colombia, Caldas, 2000 ft.	1	94	45
" " " Popayan, 6000 ft.	1	98	50
" " " Gallera, 5700 ft.	1	97	51
" " Venezuela, Barsiquimeto	1	91	42
" " Ecuador, Rio de Oro, sea-level	3	86-90	43-45.5
" " " Quito region, 8-9000 ft.	3	97-98	48-51
" " " Portovelo, 2500 ft.	1	94	47
" " Peru, Perené, 2000 ft.	1	95	44
" " " Utcuyacu, above Perené, 4800 ft.	2	98-102	49-53
" " Bolivia, Prov. Cochabamba, 7700-9400 ft.	5	98-103	50-53
" " Brazil, Matto Grosso,	1	98.5	50
" " Argentina, Tafi Trail, 2000 ft.	1	94	46
<i>P. p. patagonica</i> , Argentina, Mar del Plata	1	101	52
" " " Chile, Temuco	1	101	51
" " " " Los Andes	1	101	51
" " " " Tofo, sea-level	2	101-101.5	50-52
<i>P. p. peruviana</i> , Peru, Huaral, sea-level	3	96-97	49.5-52
" " " " Lima	2	95.5-96	51-53

MEASUREMENTS OF FEMALES

	NUMBER	WING	TAIL
<i>P. cyanoleuca</i> , Costa Rica, Turrialba, 3700 ft.	1	90	45
" " Colombia, Caldas, 2000 ft.	1	97	48
" " " San Antonio, 6800 ft.	1	96	48
" " " La Palma, 5500 ft.	1	95	47
" " Ecuador, Portovelo	1	90	45
" " Peru, Ft. Machu Picchu, 5000 ft.	1	96	46.5
" " " Santo Domingo, 6000 ft.	2	91-95.5	44.5-45
" " Brazil, Therezopolis, 3200 ft.		94	47
" " Bolivia, Prov. Cochabamba, 8800 ft.	1	99	48
<i>P. p. patagonica</i> , Argentina, Tilcara, Jujuy, 8000 ft.	1	101	52
" " " Chile, Tofo, sea-level	2	101.5-104.5	50
<i>P. p. peruviana</i> , Peru, Huaral	2	93	49
" " " " Vitarte	2	93-94	49
" " " " Huacho	1	94	49



SPECIMENS EXAMINED

Pygochelidon cyanoleuca.—COSTA RICA: San José, 1; Boruca, 2; Irazú, 2; Turrialba, 1. COLOMBIA: Caldas, 4; San Antonio, 2; Popayan, 2; Gallera, 2; Ricuarte, 1; Salento, 2; El Eden, 2; Rio Toché, 2; Sta. Elena, 2; La Palma, 1; El Carmen (near Bogotá), 1. VENEZUELA: Barsiquemeto, 2; Mérida region, 1; Caracas, 2; Guácharo, 2. BRAZIL: Therezopolis, 1; Rio region, 2; Chapada, Matto Grosso, 1. ECUADOR: Rio de Oro, Prov. Manaví, 3; 'Quito' skins, 7; Mocha, 1; Portovelo, 2; Zamora, 1. PERU: Chilpes, Prov. Junin, 1; Tulumayo, Prov. Junin, 2; Utcuyacu, Prov. Junin, 2; La Merced, 1; Perené, 2; Sta. Ana, 1; Ft. Machu Picchu, 1; Torontoy, 1; Santo Domingo, 10. BOLIVIA: Prov. Cochabamba, Incachaca, 7; Parotani, 5; Vinto, 2; Prov. Sucre, Pulque, 4; Rio Pilcomayo, 1; Rio Cachimayo, 1; California, Prov. Santa Cruz, 1. ARGENTINA: Tafi Trail, Prov. Tucuman, 2000 ft., 1, April 12. PARAGUAY: Bahia Negro, 1. URUGUAY: Lazcano, Dept. Rocha, February 7, 8 (Wetmore).

Pygochelidon patagonica patagonica.—PARAGUAY: 200 km. west of Puerto Pinasco, September 24 (Wetmore). ARGENTINA: above San Pablo, 4000 ft., Prov. Tucuman, 2, March 12; Tilcara, 8000 ft., Prov. Jujuy, 4, February 8-12; Mar del Plata, 1, October 19; Mendoza, 1, November; Zapala, Neuquen, December 8, 1920 (Wetmore); General Roca, Rio Negro, November 27, 1920 (Wetmore); N. W. Rio Negro, breeding (Peters); Tunyan, Prov. Mendoza (Peters); Protrerillos, 5000 ft., Prov. Mendoza (Peters); Protrerillos, 5000 ft., Prov. Mendoza, March 19, 1921 (Wetmore); Carhué, Buenos Aires, December 18, 1920 (Wetmore); Guamini, Buenos Aires, March 5, 7, 1921 (Wetmore). CHILE: Temuco, Cautin, 1, October; Los Andes, 2700 ft., 1, August; Tofo, 60 miles north of Coquimbo, 4, December 3-24.

Pygochelidon patagonica peruviana.—PERU: Moquega, 1; Coca-chacra, 1; Vitor, 1; Pisco, 1; Lima, 3; Chorillos, 1; Vitarte, 6; Huacho, 7; Bequeta, 3; Huaral, 14; Trujillo, 6.

Pygochelidon flavipes.—PERU: Maraynioc, the type.

GENERAL REMARKS AND CONCLUSIONS

From the preceding studies it appears that the west Peruvian form, of a group distributed from Costa Rica to Tierra del Fuego, was derived not from the north, as might be expected, but from the south. The geographical origin of the group must remain as much a matter of speculation as its ancestry. The extent and geological history of the area it

inhabits, however, indicates that *cyanoleuca* is the older of the two species composing it. This species has been shown to be chiefly mountain-inhabiting, its range being subtropical rather than tropical. If now we look for an ancestral form inhabiting the tropics we find nothing nearer to *cyanoleuca* than *Diplochelidon melanoleuca*, which differs from it

1 *P. cyanoleuca*3 *P. patagonica peruviana*2 *P. patagonica patagonica*

in the more complete adherence of the basal phalanx of the middle toe to the outer toe, its more deeply forked tail, and bluish black breast-band. The fact, however, that, without regard to locality, specimens of *cyanoleuca* often have partially black feathers in the breast, suggest that this is a vestigial character, a matter of possible significance in this connection.

However this may be, the obvious distinctness of *cyanoleuca* suggests the probability of its development in the older mountain areas of Guiana or Brazil; whence, following the coastal mountains, it, on the one hand, reached the Venezuelan Andes and, on the other, subtropical latitudes to the south.

Once in the Andean region, it found suitable conditions for range extension in the practically unbroken expanse of the Subtropical Zone, stretching from Venezuela to Bolivia but, although it has reached the Pacific coast just south of the equator, the northward extension of the Temperate Zone on the coast of Peru, under the influence of the Humboldt Current, checked its progress on the coast south of Ecuador. Furthermore, since *cyanoleuca* is found in the vicinity of forests, and probably nests in holes in trees, the absence of wooded areas on the coast of Peru would discourage it from entering that region.

Through the mountains of Panama it reached Costa Rica. It appears to be uncommon in the Isthmus at present, a fact readily to be accounted for by the subsidence which has created a hiatus in the ranges of many species common to the Subtropical Zone of Colombia and Panama, but which are wanting in the intervening area.¹

From the theoretical point of origin in the mountains of eastern South America, the range of *cyanoleuca* extends southward to subtropical latitudes in Uruguay, Paraguay, and northern Argentina. Here it meets the northern limit in this region of the range of *patagonica*, with which species it is not known to intergrade. The ranges of the two birds apparently do not overlap, but one replaces the other and they may, therefore, be regarded as representative species.

The question now arises: assuming that *cyanoleuca* is the older of the two, is *patagonica* an offshoot of it or were they derived from a common ancestor?

The fact that their ranges join but that the birds do not intergrade indicates that *patagonica* is not a geographic derivative of *cyanoleuca*

¹A list of these species is given in the author's paper on the 'Distribution of Bird-Life in Colombia,' 1917, Bull. Amer. Mus. Nat. Hist., XXXVI, p. 158.

but that both forms had acquired their distinguishing characteristics before they came into contact with each other.

Aside from these suggestions, further discussion of their origin involves a more exact knowledge of past physiographic and climatic conditions in South America than we at present possess.

Granted, however, that *patagonica* had a northern ancestor, we may follow its extension of range southward until it reached the ends of the continent. Once well within the South Temperate Zone, its further southward distribution must have occurred only during the warmer part of the year, and with the coming of winter it evidently retreated toward the north where it now remains at the junction of the South Temperate and Subtropical Zones until returning spring permits it to revisit its breeding ground. Thus has been developed the habit of migration.

It is natural to assume that the Pacific coast was reached from Argentina. Thence, west of the Andes, for the facts all indicate the birds' appearance on the Peruvian coast since the elevation of these mountains, it extended its range toward the equator following that arm of the Temperate Zone which, under the influence of the Humboldt Current, passes up the coast to the vicinity of Trujillo, the most northern point at which this swallow is known to occur. Here the counteracting forces of a cold current on the one hand and the approach to equatorial regions on the other, produce what may be termed a Subtemperate Zone, where conditions differ sufficiently from those prevailing farther south to bring about the development of numbers of new forms and our swallow now becomes smaller and presents slight but constant color characters which distinguish it from true *patagonica*, the parent form.

The case is an especially interesting one to compare with that of *cyanoleuca* and *patagonica* as outlined above. Although in both instances the differentiating characters are slight, in one we have contact of range without intergradation, in the other apparently gradual merging of one form into its representative race.

North of Trujillo the effects of a warm, southward flowing, inshore current begin to be apparent, and this vicinity marks the northern known limit on the coast of Peru of Humboldt's Penguin (*Spheniscus humboldti*) and the Diving Petrel (*Pelecanoides garnoti*) the ranges of which extend northward, as Murphy¹ has shown, to 7°, and 6° 21' south latitude respectively.

¹1920, Brooklyn Museum Quarterly, p. 91.

This study, therefore, shows that, when due consideration is given to relationships and their bearings on geographic as well as physical origin, and to those factors which determine climatic and hence faunal conditions, it is not surprising that the form of *Pygochelidon* inhabiting the coast of Peru was derived from the south instead of from the north.

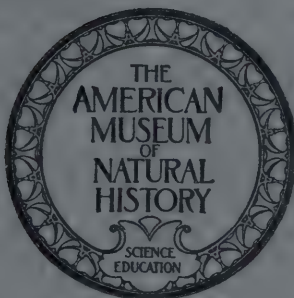
POSTSCRIPT.—In reply to an inquiry, Mr. Harry Watkins, our collector in Peru, writes from Lima that he saw no swallows at any of his several stations in the coastal region of Peru north of Trujillo. His experience in regard to these birds agrees, therefore, with that of Stolzmann at Tumbes, as quoted above.

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No. 31

DESCRIPTIONS OF APPARENTLY NEW BIRDS FROM COLOMBIA, ECUADOR, AND ARGENTINA

BY FRANK M. CHAPMAN



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DESCRIPTIONS OF APPARENTLY NEW BIRDS FROM COLOMBIA, ECUADOR, AND ARGENTINA

BY FRANK M. CHAPMAN

The following descriptions of apparently new South American birds are chiefly by-products incident to the preparation of a report on the distribution of bird-life in Ecuador. I have to thank Dr. Percy R. Lowe of the Bird Department of the British Museum, Mr. Outram Bangs of the Museum of Comparative Zoology, and Dr. E. W. Nelson of the Biological Survey, for the loan of specimens or for permission to examine the collections under their care.

Zenaida auriculata caucæ, new subspecies

SUBSPECIFIC CHARACTERS.—Similar to *Zenaida auriculata auriculata* (Des Murs) but size slightly smaller, the tail more graduated, its central feathers more pointed, the lower tail-coverts usually more or less vinaceous.

TYPE.—No. 109,386, Amer. Mus. Nat. Hist.; ♂ ad.; Cali, Colombia; August 11, 1911; Richardson and Miller.

SPECIMENS EXAMINED

Zenaida auriculata caucæ.—COLOMBIA: Cali, 3 ♂, 1 ♀; Palmira, 1.

Zenaida auriculata auriculata.—CHILE: Temuco, 1 ♂, 1 ♀; Tofo, 2 ♂.

Zenaida auriculata hypoleuca.—"Pearl Island," the type (in Brit. Mus.). ECUADOR and PERU, a large series.

On two former occasions,¹ I have called attention to the resemblance between specimens of *Zenaida auriculata* from Chile and the Cauca Valley, but the uncertainty in regard to the proper disposition of Bonaparte's name *Zenaida hypoleuca* has discouraged an attempt to determine the true status of the Colombian bird.

Examination of Bonaparte's type in the British Museum shows it to be a specimen of the form for which Bangs and Noble proposed the name *Zenaida auriculata pallens* and, in satisfactorily disposing of this question, shows also that the Colombian form is unnamed. I have therefore characterized it as above.

Its characters appear to present an exceptionally interesting case of parallelism. Briefly stated, the case, so far as it relates to specimens from the Pacific coast region, is as follows. The type form, *auriculata auricu-*

¹1917, Bull. Amer. Mus. Nat. Hist., XXXVI, p. 206; 1921, Bull. U. S. Nat. Mus., 117, p. 47.

lata, occupies Chile from at least Temuco to Tofo, sixty miles north of Coquimbo. It is characterized chiefly by its almost uniform vinaceous underparts, the abdomen as well as the breast being of this color. In Peru and Ecuador this form is replaced by one in which the abdominal region is cream-buff, with the under tail-coverts paler than in the Chilean bird. In the Cauca Valley of Colombia, however, a return is made to the characters of the Chilean bird, the bird of that region having the abdomen vinaceous, as in true *auriculata*, and indeed differing from that race but slightly in size and color. The difference in the graduation of the tail is marked and diagnostic.

MEASUREMENTS

	Sex	Wing	Tail	Extent of Tail Graduation
Cali, Cauca, Colombia	♂	139	86	23
" " "	♂	143	85	25
" " "	♂	135	88	31
Temuco, Chile	♂	152	90	14
Tofo, Chile	♂	158	92	16
" " "	♂	151	90	20
Cali, Colombia	♀	133	79	21
Palmira, Colombia	♀	135	75	24
Temuco, Chile	♀	138	75	17

***Oreopelia bourcieri subgrisea*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Oreopelia bourcieri bourcieri* (Bonap.), but underparts as in *O. frenata*, the breast pale drab-gray instead of cinnamon-drab or drab; center of abdomen slightly paler than breast, pale smoke-gray rather than drab as in most specimens of *bourcieri*; lower tail-coverts grayer.

TYPE.—No. 150,984, Amer. Mus. Nat. Hist.; ♂ ad.; Alamor, 4350 ft., Prov. Loja, Ecuador; July 10, 1919; H. Watkins.

SPECIMENS EXAMINED

Oreopelia bourcieri subgrisea.—ECUADOR: Alamor, 2 ♂ (inc. type), 1 ♀; Celica, Prov. Loja, 1 ♂.

Oreopelia bourcieri bourcieri.—COLOMBIA: 3 ♂, 8 ♀. ECUADOR: Rio Zamora, 1 ♂, 4 ♀; Zaruma, 5 ♂, 8 ♀, 2 ?.

Oreopelia frenata.—BOLIVIA: Vermejo, Prov. Santa Cruz, 1 ♂; Yungas, Prov. Cochabamba, 1 ♂.

This proposed new form is obviously an intermediate between *Oreopelia frenata* and *O. bourcieri*, its discovery indicating the intergradation of these two forms. In the color of underparts it agrees exactly with a male from Vermejo, Bolivia, while above it as closely resembles true *bourcieri*. Comparison of the type of *Oreopelia bourcieri baeza*

Chubb¹ with true *bourcieri* convinces me that it is not separable from that species, an opinion which is supported by the fact that five specimens from the Rio Zamora, in eastern Ecuador, are unquestionably typical *bourcieri*.

Specimens from Zaruma in southwestern Ecuador, north of Alamor, are intermediate between *bourcieri* and *subgrisea* and clearly demonstrate the intergradation of these two races.

Jacana scapularis, new species

SPECIFIC CHARACTERS.—Similar to *Jacana jacana jacana* (Linn.), but black of the anterior parts of the body less sharply defined from the back and extending backwards for an inch or more on the scapulars; light area of the two outer primaries white in both adults and young, untinged with greenish; chestnut areas averaging paler; size, averaging larger. ♀: Wing, 134; tail, 40; tarsus, 55; culmen, 31. ♂: Wing, 136; tail, 40; tarsus, 55; culmen, 32.

TYPE.—No. 119,626, Amer. Mus. Nat. Hist.; ♂ ad.; Chone, Prov. Manaví, Ecuador; December 16, 1912; W. B. Richardson.

SPECIMENS EXAMINED

Jacana scapularis.—ECUADOR: Chone, 1 ♂ ad., 2 ♂ juv., 1 ♀ ad.; Puna Is., 1 ♀ ad.; 'Quito,' 1 ad.²

Jacana jacana jacana.—BRAZIL, BOLIVIA, northern ARGENTINA, and PARAGUAY, a large series of adults and young.

Jacana jacana intermedia.—VENEZUELA: Sacupana, 1 ♂ ad., 2 ♂ ad.; Estado Lara, 1 ad. COLOMBIA: La Morelia, 1 ♀.

So far as I am aware, no other form of *Jacana jacana* has been recorded from west of the Andes. In Colombia we found this species only at La Morelia³ in the Amazonian Fauna, while specimens from the Magdalena and Cauca Valleys are referable to *Jacana nigra*. The range of *scapularis* is therefore separated from that of *jacana* by the Andes—an impassable barrier—and this fact, in connection with its pronounced characters, indicates the specific distinctness of the west-Ecuador bird. In this connection it is also pertinent to note that the white outer primaries characterize the immature as well as the adult bird.

Rupornis magnirostris zamoræ, new subspecies

SUBSPECIFIC CHARACTERS.—Similar to *Rupornis magnirostris magnirostris* (Gmel.) but darker, the upperparts deep neutral gray, the bars of the abdominal region and tibiae russet, the bordering gray bars darker and broader, sometimes largely

¹1917, Bull. Brit. Orn. Club, XXXVIII, p. 33 (Baeza, East Ecuador).

²This specimen, from the Lawrence Collection, is a trade skin. It, of course, did not come from Quito, but its black scapulars and white outer primaries indicate that it did come from Ecuador.

³Recorded by me (1917, Bull. Amer. Mus. Nat. Hist., XXXVI, p. 225) as *Jacana spinosa* but, following Ridgway's treatment of this group, should evidently be known as *Jacana jacana intermedia* Sel.

replacing the russet bar lying between them; bars on tibiae of the same color as those on abdomen; tail, upper tail-coverts, and under wing-coverts without trace of ochraceous or cinnamon-rufous.

TYPE.—No. 166,708, Amer. Mus. Nat. Hist.; ♀ ad.; Sabanilla, alt. 5700 ft., Rio Zamora, Prov. Loja, Ecuador; November 9, 1920; George K. Cherrie.

SPECIMENS EXAMINED

Rupornis magnirostris zamoræ.—ECUADOR: Sabanilla, 1 (the type); Zamora, 2. COLOMBIA: La Palma, 5700 ft., Huila, 1.

Rupornis magnirostris magnirostris.—SURINAM: Vicinity of Paramaribo, 9; Wannaweg, 1. VENEZUELA: Sacupana, Lower Orinoco, 1; La Union, Maripa, Lower Orinoco, 1; R. Caura, 2; Cumanaçoa, Bermudez, 1. COLOMBIA: Barrigon, 2; Villavicencio, 3; Honda, 3; Chicoral, 2; Sta. Elena, 1; Barro Blanco, 1; Atrato River, 1; Puerto Valdivia, 1; Dabeiba, 1; Bonda, Sta. Marta, 3¹; Sta. Marta, 1.²

The form here described exhibits the distinguishing characters which one would expect to find in a bird inhabiting the humid forests of the Amazonia slope of the Ecuadorian Andes. Its occurrence at La Palma, near the head of the Magdalena Valley, further emphasizes the Amazonian affinities of the avifauna of that locality, where we have already found *Piaya cayana mesura* and *Tangara cyaneicollis caeruleocephala*.²

Ciccaba æquatorialis, new species

SPECIFIC CHARACTERS.—Resembling *Ciccaba albigularis* but throat not white, crown barred instead of spotted, an evident buffy nuchal collar, outer webs of scapulars buffy, primaries barred on inner webs; abdominal region whiter.

TYPE.—No. 35,591, Amer. Mus. Nat. Hist.; "Ambato" (probably East Andean slope below Los Baños), Ecuador; M. A. Vascomez.

SPECIMENS EXAMINED

Ciccaba æquatorialis.—ECUADOR: the type.

Ciccaba albigularis.—COLOMBIA: Choachí (proposed type-locality, see Chapman, Bull. Amer. Mus. Nat. Hist., XXXVI, 1917, p. 254); 4; Bogotá, 1; Sta. Elena, Antioquia, 1 ♀; Medellin, 1. VENEZUELA: Escorial, near Mérida, 1 ♂, 1 ♀; Culata, near Mérida, 1 ♂, 1 ♀. ECUADOR: no locality, 2.

DESCRIPTION OF TYPE.—General color above dark cinnamon-brown with buffy and ochraceous markings; band from the base of bill to back of eye white slightly stained with ochraceous; whole top of head finely barred with ochraceous-tawny; a narrow nuchal band largely ochraceous-buff; auriculars ochraceous-tawny barred with black; postauricular region ochraceous-buff barred with blackish; back slightly lighter than crown, the ochraceous-tawny bars wider; outer web of most of the scapulars white tinged with buff, and terminally margined with blackish; tail brownish fuscous barred and, laterally and terminally, marbled with ochraceous-buff or ochraceous-tawny; wing-quills like the tail, their outer webs with broadly con-

¹*Rupornis magnirostris insidiatrix* Bangs and Penard.

²1917, See Bull. Amer. Mus. Nat. Hist., XXXVI, pp. 321, 598.

spicuous ochraceous-buff bars which, on the secondaries, have dusky centers; inner webs of all the quills with rather poorly defined but evident ochraceous-buff bars; wing-coverts like the back barred and mottled with ochraceous-buff and ochraceous-tawny; throat and chest ochraceous-tawny finely barred with black; breast and flanks whitish with blackish shaft-streaks, mottlings, fine broken bars and ochraceous-buff bases; lower tail-coverts and tibiae ochraceous-buff, the center of the abdomen paler. Wing, 197; tail, 98; tarsus, 24; culmen, 21 mm.

The single specimen on which this species is based has remained unidentified for years in the Museum collection in the hope of the receipt of additional material. My work on the birds of Ecuador necessitating the determination of its status, the conclusions reached are presented herewith.

In the pattern of coloration of the scapulars this species resembles *Otus nudipes*, but the resemblance ends there, the tarsus in *aequatorialis* being feathered as in *Ciccaba*, while the upperparts are finely barred instead of spotted with ochraceous-tawny; nor can I detect ear-tufts in the Ecuador bird.

The specimen on which this species is based was part of a collection containing examples of *Osculatia sapphirina*, *Pionites melanocephalus pallidus*, and other species characteristic of the eastern slope of the Andes, from which region the collection doubtless reached Ambato through Los Baños.

***Glaucidium brasilianum tucumanum*, new subspecies**

SUBSPECIFIC CHARACTERS.—Resembling the black and white-barred tail phase of *Glaucidium brasilianum brasilianum* but upperparts, wings and streaks below fuscous with (in one specimen) a barely perceptible tinge of brown; the crown with small, inconspicuous whitish spots or shaft-streaks; broken nuchal band, white; back with practically no white markings. ♂; Wing, 90; tail, 65; tarsus, 16 mm. ♀: Wing, 95; tail, 65; tarsus, 16 mm.

TYPE.—No. 140,625, Amer. Mus. Nat. Hist.; ♂; Rosario de Lerma, 4800 ft.; Prov. Salta, Argentina; January 10, 1916; Miller and Boyle.

SPECIMENS EXAMINED

Glaucidium brasilianum tucumanum.—ARGENTINA: Rosario de Lerma, 1 ♂, 2 ♀.

Glaucidium nanum.—CHILE: Tierra del Fuego, 1 ♂; Punta Arenas, 1 ♂, 1 ♀; Temuco, 1 ♂, 3 ♀; Valparaiso, 1; Rio Blanco, 1 ♂; Tofo, 60 m. north of Coquimbo, 1 ♀. PERU: Moquegua,¹ Prov. of Moquegua, 1 ♀.

Glaucidium brasilianum brasilianum.—ARGENTINA: La Valle, Santiago del Estero, 1 ♂, gray phase, 1 ♂, int. phase, 1 ♀, int. phase; Suncho Corral, Santiago

¹This specimen considerably extends the known range of this species. It is in the grayish brown phase of color with a blackish tail barred with ochraceous-tawny. The tail, however, is tipped with white and the intervening blackish areas are twice as wide as the tawny bars. The spots on the crown are larger and more numerous than in our other specimens, and the bird may represent a northern form of *nanum*. It measures: Wing, 196; tail, 78 mm.

del Estero, 1 ♂, gray phase. BRAZIL: Urucum near Corumbá, 1 ♂, rufous phase, 2 ♀, gray phase; Descalvaldos, Matto Grosso, 1 ♂, rufous phase; Chapada, Matto Grosso, 1 ♀, rufous phase, 1 ♀, int. phase, 3 ?, gray phase; eastern Brazil, 3 rufous phase (including two types of *ferruginea* Wied); Ceará, 1 gray phase, 1 rufous phase; Boa Vista, Maranhão, 1 ♀, gray phase. PERU: Ollantaytambo, Urubamba Valley, 1 ♂, gray phase; Pacific coast region, 15, both sexes and phases. Western ECUADOR: 25, both sexes and phases.

Glaucidium brasilianum phalaenoides.—TRINIDAD and Caribbean coast region of VENEZUELA and COLOMBIA, 24, both sexes and phases.

While I have no doubt of the distinctness of the form here described, I do not know whether it should be accorded specific or subspecific rank. The three specimens on which it is based are as nearly alike in color and markings as three specimens of this group can well be and are not to be matched in the large series of other forms examined. The type has a tinge of cinnamon on some of the white areas of the central tail-feathers and the crown markings are minute spots rather than shaft-streaks. All the specimens were taken on January 10 and are in full molt; the incoming plumage resembles in color that which it is replacing.

The four specimens from Santiago del Estero are apparently typical of *brasilianum*, though I have not enough eastern Brazilian material to determine this point satisfactorily. Two of these birds are in gray plumage with thickly spotted crowns and more or less white in the back and bear no close resemblance to the form here described. Five "gray" birds from Chapada and Urucum, Matto Grosso, on the other hand, agree with the Rosario de Lerma specimen in the restriction of the crown markings and lack of white on the back, but they are very much browner above than the sooty-fuscous *tucumanum*. Possibly the absence of crown-markings may be attributed to immaturity, since at least two of these Matto Grosso birds are not fully adult.

With *Glaucidium nanum* also recorded from the Tucuman¹ region, it is clear that much work remains to be done before we have a thorough knowledge of the distribution and relationships of the forms of this genus occurring in northwestern Argentina.

***Grallaricula flavirostris ochraceiventris*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Grallaricula flavirostris costaricensis* Lawr., but wing longer, bill stouter and averaging longer; ochraceous of underparts more extensive, wholly, or in part covering the abdomen. Differing from *Grallaricula flavirostris flavirostris* Sel. in its more olive upperparts, more intense color of the

¹See Dabbene, 1910, Ann. Mus. Nat. Buenos Aires, III, part 11, p. 255.

ochraceous areas; comparatively unstreaked breast and ochraceous abdomen. ♂: Wing, 68; tail, 24.5; tarsus, 21; exposed culmen, 15 mm. ♀: Wing, 67; tail, 25; tarsus, 23; exposed culmen, 15.5 mm.

TYPE.—No. 109,636, Amer. Mus. Nat. Hist.; ♂ ad.; Cocal, alt. 4000 ft., Western Andes, Colombia; June 13, 1911; W. B. Richardson.

***Grallaricula flavirostris zarumæ*, new subspecies**

SUBSPECIFIC CHARACTERS.—Similar to *Grallaricula flavirostris ochraceiventris* but all the ochraceous areas yellow, less orange-ochraceous; that of the forehead, loreal and ocular region less pronounced, the auriculars more olivaceous; black ante-orbital crescent stronger; maxilla yellow or olive-yellow, rather than dark brown. Differing from *Grallaricula flavirostris flavirostris* Scl. in having the back light brownish olive rather than Dresden-brown; the breast practically unstreaked; the abdomen ochraceous; the maxilla yellow. ♂: Wing, 65; tail, 25; tarsus, 23; exposed culmen, 15 mm. ♀: Wing, 65; tail, 25; tarsus, 22; exposed culmen, 14.5.

TYPE.—No. 129,758, Amer. Mus. Nat. Hist.; near Zaruma, alt. 6000 ft., Prov. del Oro, Ecuador; October 5, 1913; W. B. Richardson.

SPECIMENS EXAMINED¹

Grallaricula flavirostris ochraceiventris.—COLOMBIA: Cocal, the type; San Antonio, 1 ♀.

Grallaricula flavirostris flavirostris.—ECUADOR: Napo, the type; Baeza, 1; Sarayaçu, 2. COLOMBIA: Bogotá, 2; "Colombia," 2 (all in Brit. Mus.).

Grallaricula flavirostris costaricensis.—COSTA RICA: Buena Vista, 1; Sarapiquí, 1 ♀; "Costa Rica," 2. PANAMA: Veragua, 5; Chiriqui, 1 ♀ (type of *G. vegeta* Bangs).

Grallaricula flavirostris brevis.—PANAMA: Mt. Pirri, 2 ♂ (inc. type), 2 ♀.

Grallaricula flavirostris zarumæ.—ECUADOR: near Zaruma, 6000 ft., Prov. del Oro, 2 ♂ (inc. type); El Chiral, 5350 ft., Santa Rosa-Zaruma Trail, 3 ♂, 2 ♀.

Examination of the type and other specimens of *Grallaricula flavirostris flavirostris* Scl. in the British Museum enables me for the first time satisfactorily to determine our specimens of this group from the western Andes of Colombia and Ecuador. It appears that the west-Ecuador birds, which I had hitherto provisionally referred to the east-Ecuador form, are quite distinct from it. They not only have an even yellower bill but the black margins to the feathers of the breast are less pronounced than in any other race of the species, being in some specimens practically absent, while in true *flavirostris* they reach their maximum of development and are in strong contrast to the ochraceous or white portion of the feather on which they appear. Furthermore, *zarumæ*, agreeing with the other western races, has the upperparts

¹It should be stated that the specimens listed below were not all examined at the same time and direct comparison in every instance has, therefore, not always been possible. However, all this material has passed through my hands and a large part of it, including the types or topotypical specimens of every form, has been in my possession at the American Museum.

decidedly more olivaceous than *flavirostris*. The differences between the two may, in fact, prove to be specific rather than subspecific, when *flavirostris* would stand alone and the western forms would be ranked as races under the specific name of *costaricensis*. All, however, are obviously representative forms and their relationships seem most truly expressed by trinomials.

The species appears to be confined to the Subtropical Zone and the known distribution of its races is indicated by the list of localities at which specimens have been secured.

The genus has not been recorded from Peru, but is represented in Bolivia by the recently described *Grallaricula boliviana* Chapman,¹ a strongly marked species with a white chest space, the feathers of the throat as well as breast margined with black. The margins of the breast-feathers are broad, sharply defined, and usually enclose the arrow-shaped ochraceous area, producing the scaled effect which characterizes the breast of *Premnornis*.

¹1919, Proc. Biol. Soc. Wash., XXXII, p. 257.

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PRELIMINARY REPORT ON ECUADOREAN MAMMALS. No. 2

By H. E. ANTHONY



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PRELIMINARY REPORT ON ECUADOREAN MAMMALS. No. 2

BY H. E. ANTHONY

This is the second paper based upon the collection of Ecuadorean mammals made in 1920 and 1921.¹ The mammals of this expedition, some 1550 specimens, are being studied with the intention of publishing a detailed report at some future time. Additional material is being acquired in the meantime, since it is part of the plan to carry on systematic field work in this republic. Whenever new species come to light, preliminary reports, such as the present paper, will appear.

Phyllotis fruticicolus, new species

TYPE.—No. 47674, Amer. Mus. Nat. Hist.; ♂; Guachanamá, southern Ecuador; altitude, 9050 ft.; October 9, 1920; collector, H. E. Anthony. The type is a skin and skull, the latter with the sutures of the parietal region opened, but the elements have not been lost.

GENERAL CHARACTERS.—Resembling *haggardi* superficially, but differing from it in the characters of longer tail, smaller ears, grayer appearance and shorter nasals.

DESCRIPTION.—

Color above a mixture of warm buff and blackish, the general effect being decidedly grayish, the blackish coming from the dark-colored bases of the hairs, the buff strongest along the sides and about the head; below, soiled white, the hairs slate-colored at base. Ears small for the genus, colored like back without any conspicuous areas of buff or black hairs; hands and feet white; tail bicolor to match body coloring.

Skull rather lightly built; nasals very short, with median depression; interorbital constriction greatest midway of frontals, margins smooth and unbeaded.

MEASUREMENTS.—Taken in the flesh: total length, 193 mm.; tail vertebræ, 102; hind foot, 24. Greatest length of skull, 24.7 (25.3)²; length of nasals, 8.9 (10.3); zygomatic breadth, 12.4 (13.5); interorbital breadth, 3.9 (4.2); breadth of braincase, 11.8 (12.5); length of upper molar series, 4.2 (4).

The type of *fruticicolus* is a young adult, with the molar crowns showing only moderate wear, so it is possible that older specimens might show more highly colored pelage. In color the Guachanamá specimen may be closely matched by selected specimens from a large series of topotypical *haggardi*, but the new species is well characterized by the notice-

¹See 'Preliminary Report on Ecuadorean Mammals. No. 1,' by H. E. Anthony, American Museum Novitates, No. 20, November 3, 1921.

²Measurements in parentheses are those of No. 46835, *Phyllotis haggardi* from Mt. Pichincha, 12,000 ft. altitude.

ably shorter nasals and the longer tail. The ear of *fruticicolus* is smaller and less conspicuous than the ear of *haggardi*, although the series of the latter would appear to show that there is considerable individual variation in the size of the ear of *haggardi*.

The type is one of a series of three specimens, all collected at Guachanamá, on a rocky hillside overgrown with tough shrubbery.

***Microsciurus sabanillæ*, new species**

TYPE.—No. 60464, Amer. Mus. Nat. Hist.; ♀ ad.; Sabanilla, Prov. de Loja, Ecuador; altitude, 5700 feet; November 18, 1920; collector, H. E. Anthony. The type is a skin with skeleton.

GENERAL CHARACTERS.—A large species, apparently related to *avunculus*, practically unicolor above, with ochraceous underparts and lacking a postauricular spot.

DESCRIPTION.—

Color, above, between dark olive (Ridgway) and mummy brown, depending on how skin is held to the light; below, near ochraceous tawny; top of head lightly washed with ochraceous buff, but not conspicuously so; ears clothed interiorly with short hairs slightly darker in tone than the ochraceous buff of the crown; no postauricular patches; orbital ring scarcely discernible; forearms and hind limbs like back; hands like back, feet washed with same color as hairs on ears; tail, above, very similar to back, but hairs tipped with clay color, below noticeably darker than color of rest of underparts.

Skull large and characterized by long nasals and long palate, the latter extending considerably beyond plane of last molars posteriorly.

MEASUREMENTS.—Taken in the flesh: total length, 280 mm.; tail vertebrae, 146; hind foot, (c.u.), 41. Skull, greatest length, 37.8; zygomatic breadth, 22.3; length of nasals, 11.7; interorbital breadth, 13.1; breadth of braincase, 19; length of palate, 16.5; length of upper molar series (exclusive of small pm.), 6.1.

In pattern of coloration *sabanillæ* comes logically within the group of species characterized by *similis*. The uniform coloration above, without any black dorsal region or crown and with no conspicuous white or buffy areas on or behind the ears, sufficiently distinguishes this new species from the other *Microsciurus* already known from the Oriente of Ecuador, *napi* and *avunculus*, and from other members of the genus outside of the *similis* group. It is much larger than any species related to *similis* and in this respect more nearly resembles *avunculus*. The type locality of *avunculus* is given as Gualaquiza, altitude 2500 feet, while *sabanillæ* was taken in forest at an elevation of 5700 feet, which fact may account for the seemingly strange occurrence of two distinct forms so close together, since Sabanilla is on the Rio Zamora not very far distant from Gualaquiza. Thomas,¹ in the type description of *avunculus*, com-

¹1914, Ann. Mag. Nat. Hist., (8) XIII, p. 574.

pares it to *napi* which in turn is "quite like *peruanus*." Lacking specimens of both *avunculus* and *napi*, I have turned to the type of *peruanus*, which I find to be very different from *sabanillæ*, not only in the possession of white auricular patches but in cranial characters as well, since the new species has proportionally much longer nasals and longer palate.

***Marmosa perplexa*, new species**

TYPE.—No. 47188, Amer. Mus. Nat. Hist.; ♀ ad.; Punta Santa Ana, Prov. de Loja, Ecuador; altitude 3650 feet; December 21, 1920; collector, H. E. Anthony. The type is a skin and skull, the posterior part of the skull being broken. The type locality is on the trail from Zaruma to Loja and is in the interandean region, on Pacific drainage.

GENERAL CHARACTERS.—Of fairly large size, resembling a small specimen of *cinerea*, but with fur extending only a short distance onto base of tail; skull short and broad with noticeable frontal depression.

DESCRIPTION.—

Color above, Saccardo's umber (Ridgway), the hairs slaty at base; below, chamois, with light ochraceous-buff wash on pectoral region, everywhere the hairs slaty at base; orbital ring blackish, not very extensive; crown slightly lighter than dorsal region, hands and feet proximally dusky, distally soiled whitish; tail brownish above, noticeably lighter in color, faintly mottled with small, indistinct, blotches of white.

Skull rather short and broad, with heavy zygomata; a faintly developed supra-orbital bead but no supraorbital process; a marked depression in frontal area at nasal suture; first tooth of upper molar series well developed, second noticeably larger than third.

MEASUREMENTS.—Taken in the flesh: total length, 305 mm.; tail vertebræ, 178; hind foot, 22. Skull, zygomatic breadth, 19.4; least interorbital breadth, 6.2; nasals, 14×5; length of palate, to gnathion, 19; length upper toothrow, C-M⁴, 14.8; length M¹-M⁴, 7.7.

This murine opossum shows characters that would place its relationships with the *cinerea* group, were it not for the peculiarly depressed frontal region and the lack of a postorbital process, which condition is not noted in skulls of *cinerea*, *waterhousii* and *phaea*, the only species which *perplexa* appears to resemble. Skulls of *klagesi* from Venezuela show a little of the depressed frontal condition, but *klagesi* has nothing to do with *perplexa* in any other character. The material on hand for comparison is rather inadequate and consequently it is difficult to say with certainty to just what group this new species belongs.

***Marmosa oroensis*, new species**

TYPE.—No. 47180, Amer. Mus. Nat. Hist.; ♂ ad.; Portovelo, Prov. del Oro, Ecuador; altitude 2,000 feet; September 2, 1920; collector, H. E. Anthony. The type is a skin with skull.

GENERAL CHARACTERS.—A light-colored form, similar externally to *simonsi*, but with the smooth interorbital region of *fuscata* or *madescens*.

DESCRIPTION.—

Above, between drab and wood-brown, the hairs with slate-colored bases; below, ivory-yellow over entire throat and chest and medially to root of tail, the hairs unicolor to base; along sides of abdomen the light-colored hairs are slaty at base; orbital spot narrow but extending almost to end of nose, area between orbital spots above, slightly lighter in color than back; ears about like back in color; wrists and ankles dusky; hands and feet yellowish white; tail above, very similar to back in color, below distinctly lighter from base to tip.

Skull long and slender, with smooth interorbital region, no beading or postorbital processes.

MEASUREMENTS.—Taken in the flesh: total length, 294 mm.; tail vertebrae, 170; hind foot, 20. Skull, greatest length, 35.1; zygomatic breadth, 16.7; interorbital breadth, 6; nasals, 15.9×4; palate, to gnathion, 19.0; upper toothrow, C-M⁴, 13.8; length, M¹-M⁴, 6.7.

M. oroensis is somewhat like *simonsi* superficially, although it does not have quite as long pelage nor such light-colored feet and nose. Cranially the two forms have little in common since the skull of *simonsi* has marked postorbital processes. It is much lighter in color throughout than *madescens* although in cranial characters these two species are somewhat similar. It may well be that *oroensis* should stand as a subspecies of *sobrina* Thomas which is said to be related to *fuscata*. The Portovelo specimen is quite like *fuscata* in skull characters but differs from it sufficiently in external details to be distinct, while from *sobrina* it may be differentiated by the greater extent of the light-colored underparts and by the much lighter tone of the upperparts. Unfortunately, there are no available specimens of *sobrina* for actual comparison.

Apparently *oroensis* is the opossum of the semi-zerophytic tropical zone, for animals taken in the same general region but at higher elevation and in the forest are the related *celicæ*.¹

***Marmosa celicæ*, new species**

TYPE.—No. 47182, Amer. Mus. Nat. Hist.; ♂ ad.; Celica, Prov. de Loja, Ecuador; altitude, 6900 feet; September 28, 1920; collector, H. E. Anthony. The type is a skin with skull which is broken posteriorly.

GENERAL CHARACTERS.—Most like *sobrina* and *oroensis* but differing, from the former in having tail bicolor for its full length as well as in smaller size, from the latter in darker coloration and slightly different interorbital region.

DESCRIPTION.—

Color, above, near sepia with hairs slaty at base; below ivory-yellow medially, the widest area at chest, hairs unicolor to base, encroaching hairs of sides and flanks

¹See the following description.

light-tipped with slate-colored base; orbital rings extending almost to end of nose; area above included between orbital rings only slightly lighter in color than dorsal region; hands and feet dusky above, distally whitish; tail like back above, distinctly lighter below throughout entire length.

Skull like that of *oroensis* but having faint postorbital swellings of the frontal elements which appear to foreshadow postorbital processes.

MEASUREMENTS.—Taken in the flesh: total length, 278 mm.; tail vertebrae, 157; hind foot, 20. Skull, interorbital breadth across postorbital swellings, 6.8; least interorbital breadth, 5.8; nasals, 15.5×3.6 ; palate, to gnathion, 18.5; length upper toothrow, C-M⁴, 13.5; M¹-M⁴, 6.5.

M. celicæ is very closely related to *oroensis* but can be distinguished by its darker color above, its much more restricted yellow underparts and its swollen frontals. Skulls of two females show some of this swelling but not to the same degree as seen in the skull of the male (type). From *sobrina* this new form differs in having a distinctly bicolor tail as well as a somewhat smaller skull. The acquisition of more material is necessary to determine the degree of relationship between *celicæ* and *oroensis* which I suspect may prove to be subspecific, or perhaps both may be best treated as subspecies of *sobrina*.

M. celicæ was taken at Celica and Alamor near the Peruvian border and at Salvias, in the forest near the headwaters of the Rio Amarillo. The altitudinal range as established by these records is from 3500 feet to 6900 feet, all three localities in forest.

***Marmosa bombascaræ*, new species**

TYPE.—No. 47186, Amer. Mus. Nat. Hist.; ♀ ad.; Zamora (junction of Rio Bombascaro with Rio Zamora), Prov. de Loja, Ecuador; November 24, 1920; collector, H. E. Anthony. A skin in fair condition (eaten about tail and feet by ants while in trap), with skull.

GENERAL CHARACTERS.—Most like *musicola*, but larger and lacking postorbital processes on the supraorbital border, but with well-developed beading.

DESCRIPTION.—

Color above, intermediate between cinnamon and russet, the hairs slate-colored at base; below ochraceous buff, the hairs of the median area unicolor to the base, elsewhere slaty; orbital area black, small subtriangular area between orbital rings noticeably lighter than the rest of upperparts; hands dusky, feet soiled whitish; tail brownish, only slightly lighter below, no white tip.

Skull heavily built, with conspicuous supraorbital bead, wide flaring zygomata and no postorbital process on the supraorbital border.

MEASUREMENTS.—Taken in the flesh: total length, 313 mm., tail vertebrae, 187, hind foot, 21. Skull, greatest length, 34.5; zygomatic breadth, 19.3; interorbital breadth, 6.5; nasals 15×4.3 ; length of palate, to gnathion, 19.2; length of upper toothrow, C-M⁴, 13.4; length, M¹-M⁴, 7.

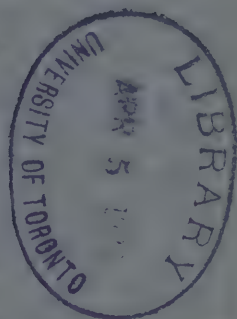
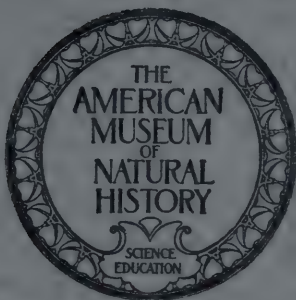
M. bombascaræ appears to be closely related to *musicola* Osgood. Superficially it is best characterized by its soft, lax fur of moderate length, the strongly yellow underparts, and the tail without any white. The type skin, that of a female, has the inguinal area suffused with vinaceous as is also the case with a female of *musicola*. But for the differences in cranial characters, I should have made *bombascaræ* a subspecies of *musicola*. However, the skull of the new species is so distinct in size and the detailed structure of the interorbital area, that the relationship calls for full specific separation.

AMERICAN MUSEUM NOVITATES

No. 33

BEEES OF THE GENUS *PERDITA* FROM THE WESTERN STATES

By T. D. A. COCKERELL



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BEES OF THE GENUS *PERDITA* FROM THE WESTERN STATES

By T. D. A. COCKERELL

The bees recorded below, with the exception of *Perdita wickhami*, were obtained by Dr. Frank E. Lutz and his associates during their exploration of the Western States for The American Museum of Natural History. They were collected by Dr. Lutz, except where the contrary is stated. The collection adds ten species and three races or varieties to the already long list of western *Perdita* and greatly extends our knowledge of distribution. The material of the *Cockerellia* group (*albipennis*, etc.; large forms, with stout, bent mandibles in the female) is particularly interesting and has suggested a discussion of the evolution of the species and races.

Perdita wootonæ Cockerell

COLORADO: 5 ♂, 4 ♀, Pueblo, vacant lots in town, August 9, 1920; 1 ♀, 2 ♀, La Junta, August 12, 1920, Mrs. F. E. Lutz, collector; 2 ♂, Wray, August 17-19, 1919; 1 ♂, Tennessee Pass, about 10,300 ft. alt., August 1, 1919, H. F. Schwarz, collector.

For the characters of this species, see 1907 Entomological News, XVIII, p. 57. The two Wray males differ greatly in the size of the head. The specimen labelled Tennessee Pass has an unusual amount of black pigment about the lateral ocelli, but the locality seems almost incredible, as the bee is an oligotropic visitor of *Nuttallia*, which is not likely to occur at such an altitude. Rydberg has recorded *N. speciosa* (Osterhout) from 10,000 ft., but this also seems improbable. It may be, however, that *Nuttallia* and *P. wootonæ* do occur at Tennessee Pass in a favorable exposure.

Perdita solitaria Cockerell

ARIZONA: 2 ♀, Sabino Basin, Santa Catalina Mts., about 3800 ft. alt., August 15-21, 1916.

Described from New Mexico.

Perdita callicerata Cockerell

ARIZONA: 1 ♂, southwest end of Coyote Mountains, about 3500 ft. alt., at flowers of *Baileya multiradiata*, August 4, 1916.

Described from New Mexico, where it visits *Baileya*.

***Perdita heliophila* Cockerell**

COLORADO: 2 ♀, Mesa Verde National Park, about 6000 ft. alt., at *Helianthus petiolaris*, July 4, 1919.

Described from New Mexico (1916).

***Perdita albipennis* Cresson**

COLORADO: 6 ♀, 1 ♂, Wray, most of the females at *Helianthus*, August 17, 1919, one collected by Pearce Bailey, Jr.; 1 ♀, Grand Junction, at *Helianthus*, July 17, 1919; 2 ♀, 1 ♂, Grand Junction, near town, August 3, 1920; 12 ♀, 10 ♂, La Junta, August 12, 1920, one ♀ collected by Mrs. Lutz, one ♂ from very arid hills, four of the males show yellow markings on the abdomen (var. *helianthi* Ckll.); 3 ♂, Glenwood Springs, at edge of town, July 22–29, 1919 and August. 5, 1920, one collected by Mrs. Lutz is var. *helianthi*; 1 ♂, Pueblo, vacant lots in town, August 9, 1920; 1 ♂, Montrose, July 19, 1919, H. F. Schwarz, collector.

***Perdita pallidipennis indianensis*, new subspecies**

♂ (Type).—Clypeus and sides of face wholly without light markings; anterior tibiae without a pale stripe; margin of stigma and end of marginal cell fuscous.

♀.—Not appreciably differing from the typical form.

INDIANA: 1 ♀, 1 ♂, Lafayette, August 16, 1920.

The female is easily known from *albipennis* by the dark hair on outer side of hind tibiae, and the dark, rounded apical plate of abdomen. The species *P. pallidipennis* Grænicier was described from Wisconsin.

***Perdita verbesinæ* Cockerell**

ARIZONA: 1 ♂, Tucson, at *Helianthus*, August 14–17, 1916, collected by Mr. J. A. G. Rehn.

Compared with New Mexico specimens, it is more robust, with unusually large head; prothorax above flattened, with a pair of light stripes on hind border; mesothorax shining yellowish green, slightly coppery in middle.

***Perdita lacteipennis* Swenk and Cockerell**

COLORADO: 3 ♀, 4 ♂, Wray, August 17–19, 1919; 14 ♀, 10 ♂, Mesa Verde National Park, at *Helianthus petiolaris*, July 3–7, 1919; 1 ♂, Grand Junction, at *Helianthus*, July 17, 1919; 2 ♀, 1 ♂, Grand Junction, near town, August 3, 1920; 4 ♂, La Junta, August 12, 1920; 1 ♀, Durango, at *Helianthus petiolaris*, July 2, 1919; 1 ♂ (abdomen marked with yellow, much as in var. *helianthi* of *albipennis*), Fruita, July 16, 1919. UTAH: 1 ♀, 1 ♂, Ogden, August 29, 30, 1916.

Females of *lacteipennis* from Ogden, Durango, Grand Junction, and the Mesa Verde National Park have the immaculate face of *Perdita canadensis* Crawford. A female *P. canadensis* collected by Professor Stevens at Sheldon, North Dakota, differs from these by the yellow

tubercles and very dark apical plate of abdomen. Crawford's description, however, indicates dark tubercles. Crawford notes that *canadensis* has the first recurrent nervure interstitial (or nearly so) with the transverse cubital, whereas in *lacteipennis* it enters the second submarginal cell some distance from the base. Our insects have the *lacteipennis* venation, but I observe that one of the Grand Junction females (though not the other) has the recurrent interstitial. The typical female *lacteipennis* has a pale vertical stripe or bar on the clypeus, but I have a cotype, from Niobrara, Nebraska, with the unmarked *canadensis* face and the *lacteipennis* venation. The Wray *lacteipennis* are typical. The males of *lacteipennis* vary in the size of the head and in the presence or absence of a yellow stripe on the scape. The original description cites a stripe on the scape, but a cotype lacks it. In four Wray males, it is present on two. Other sets of males vary similarly in the stripe.

I can only conclude that *canadensis* is a form of *lacteipennis* which occurs northward as a distinct subspecies (see Grænicher, 1914, Canadian Entomologist, XLVI, p. 52) and is represented in western Colorado and Utah by an insect which is neither pure *canadensis* nor typical *lacteipennis*. As *lacteipennis* varies in Nebraska to the dark-faced (♀) condition, it seems impossible to recognize two species.

The question next arises, whether *lacteipennis*, *canadensis*, and *heliophila* may not all be reduced to races of *albipennis*. At La Junta, males which could only be referred to *lacteipennis* occurred along with *albipennis* males. The only females to go with them were six in which the vertical light bar on the clypeus was very distinct, but the lower margin of the clypeus, instead of being pale right across, presented only lateral spots, these sometimes obsolete. One or two of these specimens could be referred readily enough to *lacteipennis*, but they certainly are all one thing, and others must be called *albipennis*. Indeed, Cresson's original description of *albipennis* (clypeus with a longitudinal yellow line down middle and a transverse yellow spot on each side) indicates just such an insect, and the more highly colored examples which seem best to typify the species (biologically speaking) are marked as is described for var. *lingualis* Ckll.

Swenk has investigated this matter in Nebraska and concludes that *lacteipennis* is a valid species, because it and *albipennis* occur together "and are yet perfectly distinguishable," while *albipennis* occurs alone in eastern Nebraska. In a similar manner, *albipennis* abounds in New Mexico, where it is not accompanied by *lacteipennis*; in southern New Mexico the *helianthi* form is the only one and hence assumes the char-

acter of a distinct race. Strictly speaking, typical *albipennis* (from the standpoint of nomenclature) is the insect of southeastern Colorado and northern New Mexico, which appears more or less intermediate between the more highly colored (*lingualis*) *albipennis* and *lacteipennis*. The *lingualis* form ("clypeus yellow with two black blotches above, sufficient to mark out the yellow T"), described from Fort Collins, Colorado, stands as a race¹; but it is very variable, and its limits have not been defined. The character of its tongue mentioned in my description is probably of no value, depending on the condition of the organ; but the palpal character may be more significant. The differences in the form of the clypeus of these bees, to which Crawford calls attention, seem to be variable and of uncertain value.

I can only conclude that this group of *Perdita* is undergoing modification through the mutation of determiners, after the manner of *Drosophila*. These changes are not adaptive and are at least largely independent, so that after defining a species or race as possessing a particular series of characters one is confused by finding that in other localities these characters are not associated. So far as the *albipennis-lacteipennis-heliophila-helianthi-lingualis* series goes, there has been no change in feeding habits, all being visitors of *Helianthus*. Whether the local distribution indicates any special adaptations to climate, we do not know. It appeared natural to find the more melanic form (*canadensis*) northward, but dark-faced insects in western Colorado and Utah were not to be expected. In New Mexico, evident offshoots from this group have become adapted to different flowers; such as *P. verbesinæ* Cockerell and *P. lepachidis* Cockerell. In Lower California there is a species (*P. sparsa* Fox) which flies in March instead of middle and late summer.

The processes leading to the formation of new species among these bees may probably be as follows.

- (1). Factorial mutations, usually independent of one another and having no adaptive significance.
- (2). Crossing between mutants and the formation of new heterozygous and homozygous genotypes.
- (3). The sorting out, in different localities, of certain characters or combinations of characters as dominant (in the sense of prevalent), possibly but not necessarily aided by natural selection or sexual selection (the latter implying preference only in the sense of recognition).

¹Cresson's *P. hyalina*, based on Colorado males, may be applicable to (and the prior name for) *lingualis*, but this is at present uncertain.

(4). The occasional coincidence of adaptive features (often physiological, or such morphological ones as size, length of tongue, etc.) which favor a change of habits or environment and permit the insects to escape from their former routine and, e.g, become attached to a different genus of plants. Observation shows that *P. albipennis*, a sunflower bee, strays to *Verbesina*. *P. verbesinæ*, a *Verbesina* (*Ximenesia*) bee, strays to *Helianthus*. When the normal flower is over, species of *Perdita* will visit other flowers. Thus there is a continual process of experimentation going on, and, if any group of bees has varied in such a manner as to make the new plant acceptable, it will readily become addicted to it and spread into those localities in which it grows. The color characters, or slight morphological differences, observed in the cabinet need not be adaptive but may only mark a race which has more subtle adaptive features. In some cases, the adaptation may be negative, the loss of some hindrance to the new mode of life.

(5). The new type having become isolated on a new plant, or geographically or seasonally, will eventually settle down to a new position of stability (aided by natural selection, which can just as well be a conservative force) which will be sufficiently remote from that of the parent species to maintain it as a distinct entity in nature, and usually prevent crossing. The complexity of the genitalia will cause comparatively slight modifications to result in physiological isolation.

Those who find it difficult to visualize these processes, should remember that, whereas variation is common and there is a continual pressure on the periphery of the environment, the development of a new species is a rare event like the winning of a prize in a lottery. The *albipennis* group of *Perdita* (Ashmead's genus *Cockerellia*) must have taken many thousands (probably hundreds of thousands) of years to produce the quite moderate series of known segregates.¹ This fact, so far from being contrary to the Darwinian hypothesis, shows the inadequacy of mutation ALONE to produce new species UNDER ORDINARY CONDITIONS OF LIFE. It is of course true that a mutating species may under experimental conditions give rise to a long series of materially different stable (homozygous) types, which when isolated will have the aspect of species. In nature, however, such isolation does not ordinarily occur unless aided by functional efficiency. This is no doubt peculiarly true of insects, the lives of which are relatively complex and full of special adaptations. In the case of some other organisms the functional side of specific char-

¹Allowance must be made for forms not yet described and for others which may have become extinct, but, even so, the number is probably not large. For a further discussion of this group, see Proc. Acad. Nat. Sci., Philadelphia, 1896, pp. 42-45.

acters is harder to explain. Thus, the island of Porto Santo, six miles long, has a marvellous series of diverse helicoid snails living under essentially the same environment. It is impossible to perceive any special adaptive significance in all this diversity, unless it lies in the attraction of like to like and consequent physiological isolation of divergent strains. Everything indicates that the snail fauna of Porto Santo is much older than the insects or plants (with rare exceptions) of the same island; the snails have survived because lacking in minute and complicated adaptive features. But, having thus survived, they have had longer to become diversified within the area.

If the above picture of bee-evolution is correct, it appears to follow that the actual segregation of a new species may occur in a relatively short time, so that the whole process might conceivably fall under human observation. It would only be noticed, however, in a region where the bees were very well known and where observations were minute and continuous. Even then, the chances of witnessing such an event would of course be remote. Much light may be thrown on the matter by careful and persistent experimental work, following such methods as those of Mr. F. C. Craighead, lately published in *Journal of Agricultural Research*, XXII, No. 4, pp. 189-220.

***Perdita snowii* Cockerell**

COLORADO: 1 ♀, Meadows, Estes Park, August 17, 1919, collected by Mr. Herbert F. Schwarz.

Originally described from Estes Park.

***Perdita sexmaculata* Cockerell**

COLORADO: 1 ♀, Regnier, at *Sphæralcea coccinea* in Gallinas Canyon, about 4400 ft. alt., June 6, 1919.

Originally described from Santa Fe, New Mexico. The specimen on *Sphæralcea* must have been a stray, as the species normally visits *Chamæsaracha*.

***Perdita ignota* Cockerell**

COLORADO: 1 ♀, Aspen, July 24-27, 1919, collected by Pearce Bailey, Jr.; 2 ♀, Tennessee Pass, about 10,300 ft. alt., August 1, 1919; 3 ♀, Boulder, two in town at *Grindelia*, one along canyon bottom toward Orodell, about 5600 ft. alt., August 7-12, 1919; 7 ♀, 31 ♂, Glenwood Springs, at edge of town, July 22-29, 1919, all except one male collected by Herbert E. Schwarz; 2 ♂, La Junta, August 12, 1920; 1 ♂, 1 ♀, Golden on top of Castle Rock, about 6200 ft. alt., August 6, 1919.

The Golden female is peculiar for having a transverse semilunar supraclypeal mark. A similar supraclypeal mark occurs in specimens of *P. xanthismæ sideranthi* Cockerell.

Perdita ignota was described from Mesilla, New Mexico, and appears to have a most unusual range in altitude and latitude for a species of this genus. There are three related forms, having no supraclypeal mark, the females of which differ thus:

Margin of stigma and adjacent nervures fuscous; abdomen without markings.

bishoppi Cockerell.

Margin of stigma and adjacent nervures wholly pale; abdomen nearly *always* with transverse white bands or marks.

Flagellum orange beneath.....*ignota* Cockerell.

Flagellum dull ferruginous beneath.....*crawfordi* Cockerell.

P. bishoppi, from Texas, is a good species but, after reviewing the available materials of *ignota* and *crawfordi*, I find that the described difference in the lateral face-marks is not constant and the antennal character is unimportant. On the antennal character, the specimen originally recorded from Lincoln, Nebraska, and those from Boulder, Colorado, and Texas, are *ignota*. It appears that *crawfordi* must fall as a slight variation of *ignota*, unless new characters for the separation of the northern and southern specimens can be found.

Another closely related species is *P. heterothecæ* Cockerell, from Arizona.

***Perdita melanochlora*, new species**

♀.—Length about 4.5 mm. Belongs to the *ignota* group. Wings clear, but margin of stigma and of marginal cell dusky; clypeus white with two short broad black bars; no supraclypeal mark; lateral face-marks broader than high (higher than broad in *P. heterothecæ*); face and front very hairy (much more so than in *heterothecæ*); flagellum dull brown beneath (orange in *ignota* and *heterothecæ*); mesothorax shining black, anteriorly and narrowly posteriorly green; metathorax blue; legs sepia brown; tarsi dilute sepia (not light as in *ignota*); segments 2 to 4 of abdomen with transverse cream-colored bands, the first two narrowly interrupted, the third deeply notched medially in front and behind; the bands are preceded by more or less evident pale brown bands.

ARIZONA: 1 ♀, about 3425 ft. alt. in the Santa Rosa Valley near the Comobabi Mountains, among mesquite and acacia with some pale verde and a few *Carnegia gigantea*, August 10, 1916.

Closely allied to *P. ignota* and *P. heterothecæ*, but distinct.

***Perdita lutzi*, new species**

♀.—Length about 5 mm. Head and thorax green, the metathorax steel blue, mesothorax rather bluish green in front and yellower green in middle; head broad, not enlarged, cheeks unarmed; front and vertex dullish, but mesothorax highly polished; mandibles straight; face-marks, labrum and mandibles (except reddened tips) dull yellowish white; clypeus light except two faint short bars; a small transverse supra-

clypeal mark; no dog-ear marks; lateral marks very broad below, narrowing (the inner margin beyond clypeus practically straight) to a very sharp point on orbit well above level of antennæ; malar space light, but cheeks dark; tubercles and two transverse marks on upper border of prothorax light; there is also a small light mark on each side of prothorax anteriorly; mesothorax with thin white hair; tegulæ hyaline; wings milky white, with colorless stigma and nervures; legs dark basally, but tibiæ and apices of femora pale yellow, tarsi white; abdomen apricot-color above and below the first two dorsal segments with straight very pale brownish bands, not reaching lateral margins.

ARIZONA: 1 ♀, southeast and of Coyote Mountains, about 3500 ft. alt., at flowers of *Baileya multiradiata*, August 5, 1916.

A distinct species closely resembling *P. mellina* Cockerell, but the latter is easily distinguished by the steel-blue, highly polished front. It is singular that this species is quite different from those which visit *Baileya* in Southern New Mexico, but one of the New Mexico *Baileya* species (*P. callicerata*) was taken with it.

***Perdita nebrascensis* Swenk and Cockerell**

COLORADO: 3 ♂, Wray, August 17–19; one collected by Pearce Bailey, Jr.

***Perdita affinis* Cresson**

COLORADO: 14 ♀, 9 ♂, Meeker, at *Grindelia serrulata*, July 20–21, 1919; 9 ♀, Estes Park, July 18, 1916, and August 18–19, 1919, collected by Mr. Albert E. Butler and Mr. Herbert F. Schwarz; 1 ♂ (on top of Castle Rock), 1 ♀, Golden, August 8, 1919; 1 ♂, Walsenburg, sabina and pinyon country, June 14, 1919.

Compared with the Meeker *affinis*, the Golden form is larger in the female and with longer white marks on abdomen, while the male has conspicuous yellow marks on the fourth abdominal segment, these in the Meeker males being small or absent.

***Perdita octomaculata terminata*, new subspecies**

I find that the supposed *P. affinis* recorded from West Point, Nebraska, at *Solidago rigida*, collected by J. C. Crawford, is without dog-ear marks in the male and represents a western race of *P. octomaculata* Say. It differs from true *octomaculata* in the cream-colored (colored as in *affinis* but shaped as in *octomaculata*) marks on abdomen of female, and in the large quadrate (notched above) supra-clypeal mark of male. It may be known as *Perdita octomaculata terminata*. The male is the type.

***Perdita zebrata* Cresson**

COLORADO: 1 ♂, White Rocks, near Boulder, at *Cleome serrulata*, August 13, 1919; 5 ♂, Wray, August 17–19, 1919; 11 ♀, 6 ♂, La Junta, August 12, 1920, three ♀ collected by Mrs. F. E. Lutz; 3 ♀, 3 ♂, Pueblo, vacant lots in town, August 9, 1920; 7 ♂, 22 ♀, Rifle, some from edge of swamp along railroad and the rest from an

almost bare sandy place used as a playground,¹ July 19–21, 1919; 4 ♀, 3 ♂, Grand Junction, two near town, one male remarkably small and slender, little more than 3 mm. long, August 3, 1920, the other along irrigated land, July 17, 1919; 1 ♂, Meeker, July 21, 1919; 2 ♂, 1 ♀ (with pale abdominal bands), Glenwood Springs, at edge of town, July 22–29, 1919 and August 5, 1920; 1 ♀, Ridgway, July 10, 1919. UTAH: 1 ♂ with white face-markings and more black on abdomen than usual, Huntsville near Ogden, July 26, 1920. WYOMING: 3 ♂, 2 ♀ (1 ♂ along the river, the rest on dry slopes near the river) Green River, July 2, 1920; 8 ♂ (one at *Cleome lutea*, which was practically the only bee-flower in the locality), 5 ♀, Rock Springs, June 29, 1920.

The Wyoming females have the bands on the abdomen lemon-yellow; those in New Mexico and many parts of Colorado (e.g., at Rifle) have the bands white or yellowish white. Cresson's type had yellow bands; the more southern form, which is sexually dichroic, could be called *P. zebrata canina* (*P. canina* Cockerell). However, of four females from Grand Junction, one has lemon-yellow bands, one has them yellowish white, and two have them pale yellow.

***Perdita bruneri* Cockerell**

WYOMING: 1 ♂, Sheridan. C. W. Metz collection.

This exactly agrees with a male of *P. cockerelli* Crawford, received from Crawford. Crawford later decided that this was the true male of *P. bruneri* and described what had been called male *bruneri* as *P. swenki*.

***Perdita fallax fontis*, new subspecies**

♀.—Clypeus with a very large cream-colored or yellowish-white triangular area, the apex directed upwards, the sides considerably longer than the base; rest of clypeus black, except a small oblique (parallel with sides of triangle) stripe on each side; mesothorax yellowish green; wings not quite so clear; pale marks on first three abdominal segments smaller.

COLORADO: 1 ♀, Glenwood Springs, at edge of town, August 5, 1920.

P. fallax Cockerell was described from New Mexico and is known to extend north to Nebraska. *P. fallax fontis* is a submelanic form, probably racial, but possibly an individual variation.

***Perdita miricornis*, new species**

♂ (Type).—Length a little over 4 mm. Head and thorax green, the front dull and bluish green, the mesothorax and scutellum brassy green, highly polished; face, cheeks, mesothorax, pleura and anterior femora with long white hair; mandibles (except red ends), labrum and face-marks cream-color, the face nearly all pale below level of antennæ; clypeus light with two dots; supraclypeal mark large, notched above; dog-ear marks present; lateral marks large, cuneiform, ending acutely on

¹Three of the females (two from the damper and one from the drier spot) have the supraclypeal mark divided into two spots and the clypeus black with light markings.

orbits at about level of antennæ; cheeks wholly dark; antennæ pale yellow below (in front) and black behind, but last two joints of flagellum entirely black, giving the antennæ a very unusual appearance; tubercles cream-color, upper border of prothorax with indistinct pale lines; metathorax green; knees, anterior tibiæ except a large dark patch behind, middle tibiæ in front, and hind tibiæ at base, pale yellow; tarsi white, the hind ones dark apically; tegulæ pale; wings perfectly clear, stigma yellowish white, nervures colorless, poststigmatal part of marginal cell shorter than substigmatal; abdomen shining black, with bright lemon-yellow markings, consisting of two spots on first segment, and broad entire bands on 2 to 6, on 2 failing laterally, on 4 and 5 sometimes interrupted sublaterally.

♀.—Similar to the ♂, but clypeus black with a median creamy-white stripe, narrowing to a point above; no dog-ear or supraclypeal marks; lateral face-marks broad-triangular, the lower and outer sides much shorter than the inner; apical part of mandibles with a black stripe; antennæ narrowly pale beneath to apex; anterior and middle tibiæ clear pale yellow, the middle ones sometimes with a dusky mark behind; spots on first abdominal segment large and transverse; bands pale yellow, very broad, the hind margins of those on third and fourth segments irregular or undulate.

WYOMING: 20 ♀, 11 ♂, Green River, on dry slopes near the river, about 6100 ft. alt. (type locality), July 2, 1920. COLORADO: 1 ♀, Grand Junction, near town, about 4500 ft. alt., August 3, 1920.

The male runs near *P. zebrata* in the tables but is easily distinguished by the antennæ and other characters. The female runs to the vicinity of *obscurata*, *bigeloviæ*, or *nitidella*, but is very distinct from these. The variety *leucorhina* (see below) runs in the tables near *nitidella*, *albovittata*, *callicerata*, and *mentzeliarum*, but is quite different from all these.

***Perdita miricornis leucorhina*, new variety**

♀.—Clypeus yellowish white except the usual dots and two black spots on upper part.

WYOMING: 1 ♀, Green River with typical form.

***Perdita wunderi*, new species**

♀.—Length about 7 mm. Head oblong, facial quadrangle much longer than wide; front, vertex, mesothorax and scutellum dull olive-green; prothorax, mesopleura and metathorax bluish green, but the region just below and behind the wings is yellowish, almost brassy; clypeus very pale yellow, with a very large thick black horseshoe-shaped mark, the middle part on the lower margin; no supraclypeal mark; lateral marks L-shaped, with the lower part very thick; face not hairy; cheeks entirely yellowish green, distinctly shining; labrum piceous, depressed in middle; mandibles slender, gently curved, pale yellowish, broadly ferruginous apically; flagellum dull pale ferruginous beneath except at base; mesothorax with short hair; no light color on thorax; wings milky hyaline, nervures rather dilute fuscous, stigma hyaline with a fuscous margin; first recurrent nervure meeting first transversocubital; legs piceous, with anterior knees and tibiæ in front light yellow; abdomen piceous, first

three segments each with a pair of obscure slender transverse yellowish lines, representing rudimentary bands. Maxillary palpi 6-jointed. Claws cleft.

COLORADO: 1 ♀, Wray, August 1, 1919.

Differs from *P. nebrascensis* Swenk and Cockerell by the green metathorax, marking of clypeus, absence of supraclypeal mark, shape of lateral marks, scape black with obscure reddish ends, color of flagellum, dark tubercles, etc. In the tables it runs near *P. verbesinæ*, but is easily separated by the dull thorax.

It is dedicated to Mr. Chas. Wunder, who with extraordinary skill and patience mounted the whole collection, making it available for study.

***Perdita bisignata*, new species**

♀.—Length about 4.5 mm. Head and thorax dark bluish green, the mesothorax posteriorly black, the metathorax (dull above) dark blue; labrum, base of the slender gently curved mandibles, and face-marks lemon-yellow; clypeus yellow with the usual dots, and two black cuneate marks above, their base on the upper margin, supraclypeal area with a pair of elongated spots or bars; lateral marks shaped like a shoe with very slender toe and flat sole, based on orbit, the very acute upper end at level of antennæ; cheeks entirely dark; flagellum pale ochreous beneath; front dull, vertex shining; mesothorax dullish; wings dusky, stigma and nervures dark brown, the outer recurrent pallid; legs black with pale knees, anterior tibiæ broadly and middle ones more narrowly pale yellowish in front, anterior and middle tarsi pale reddish; abdomen shining black, with a small yellow spot at each side of third segment.

INDIANA: 2 ♀, Lafayette, about 550 ft. alt., August 16, 1920.

Runs near *P. asteris* in the tables, but very distinct.

***Perdita nolinæ*, new species**

♀.—Length about 5 mm. Head and thorax (including front) shining green; face blue-green; mesothorax olive-green, the posterior disc black; metathorax bluish green, very shining; the following parts yellow, labrum, mandibles (except tips), clypeus (except the usual dots and two spots above, varying to distinct bars), minute transverse lateral face-marks (just above lateral extensions of clypeus), anterior border of prothorax above and a pair of minute spots on posterior border, and tubercles broadly; head broad; face not hairy; scape reddish at ends and dark in middle; flagellum dusky yellowish (or reddened by cyanide) beneath; mesothorax with very thin short hair; wings clear hyaline, nervures colorless, substigmal portion of marginal cell much longer than poststigmal; legs yellow, with the hind tibiæ and tarsi dark brown, and the anterior femora black on basal half in front, and more than half behind; abdomen black with broad entire yellow bands at bases of segments 2 to 4 not continued to lateral margins and an apical band on fifth segment; venter yellow.

ARIZONA: 2 ♀, Sabino Basin, Santa Catalina Mountains, about 3800 ft. alt. Type, among river-bottom vegetation, July 8–20, 1916; cotype, at flowers of *Nolina microcarpa*, July 8–12, 1916. The cotype has pale lateral dots on sides of face.

The nearest relative seems to be the Californian *P. rhois* Cockerell. In my table in Proc. Acad. Nat. Sci., Philadelphia, 1896, *P. nolinæ* runs out at 69.

***Perdita calloleuca*, new species**

♂.—Length about 3 mm. Dark parts of head and thorax shining dark bluish green; the following parts white, tinged with yellowish dorsad, as on front and upper part of prothorax, face up to level of facial foveæ (with a further short broad extension in middle), labrum, mandibles (except tips), large quadrate or triangular area on lower part of cheeks, prothorax including tubercles, and large patch (emarginate posteriorly) on anterior part of mesopleura; head large, quadrate, facial quadrangle broader than long; cheeks simple; mandibles long, slender and curved; mesothorax small, highly polished, not conspicuously hairy; scape very pale yellow; flagellum light yellow beneath, above reddish, more dusky at base; wings clear hyaline, nervures colorless, except margins of stigma and marginal cell, which are fuscous; legs pale lemon-yellow, hind tibiæ and tarsi brown behind; abdomen with broad entire lemon-yellow bands on all the segments, broader than the black intervals between them; venter yellow.

COLORADO: 2 ♂, Grand Junction, along irrigated land near town, about 4600 ft. alt., July 17, 1919.

Allied to *P. pellucida* Cockerell, but differs by shining vertex, and ornamentation of cheeks and abdomen.

***Perdita solidaginis*, new species**

♂.—Length, 5 mm. or a little over. Head and thorax bluish green, the mesothorax a yellow-green, shining but not polished; mandibles (except tips), labrum, face below level of antennæ, and lateral marks forming acute angles on orbits about half-way up front, all pale yellow; posterior orbits with a very narrow yellow line more than half-way up cheeks; cheeks, vertex and pleura with long white hair, but face not hairy; scape pale lemon-yellow, with only a small dark spot behind; flagellum dark brown above with the suture darker, pale yellow below, the last joint brown; narrow anterior border and two large cuneiform marks on hind border of prothorax above, tubercles and a zigzag line below, yellow; tegulæ hyaline with a pale yellow spot; wings clear hyaline, nervures and stigma very pale brown; substigmatal part of marginal cell about as long as poststigmatal; legs yellow, all the femora mainly black behind, the hind ones yellow only above and at ends; anterior and middle tibiæ with a large black mark behind, hind tibiæ black with a yellow stripe in front; anterior and middle tarsi whitish, hind tarsi dark; abdomen black with narrowly interrupted transverse lemon-yellow bands on first five segments; venter yellow, brownish subapically, and with four round brown spots subbasally.

COLORADO: 1 ♂, White Rocks near Boulder, at flowers of *Solidago*, August 13, 1919. Collected by Mrs. W. P. Cockerell.

Allied to *P. sphæralcææ*, but face considerably longer, etc. Very close to *P. erigeronis* Cockerell, but larger, face-marks much more narrowly cuneate, and legs differently colored. *P. rectangulata* Cockerell was described from the male and female taken at *Solidago* at Fort Collins, Colorado. The female is the type, and it is now known that the male supposed to belong with it is *P. affinis*. It may be that *P. solidaginis* is the real male of *P. rectangulata*, but, as the probabilities seem to be against it, I describe it as distinct.

***Perdita wyomingensis*, new species**

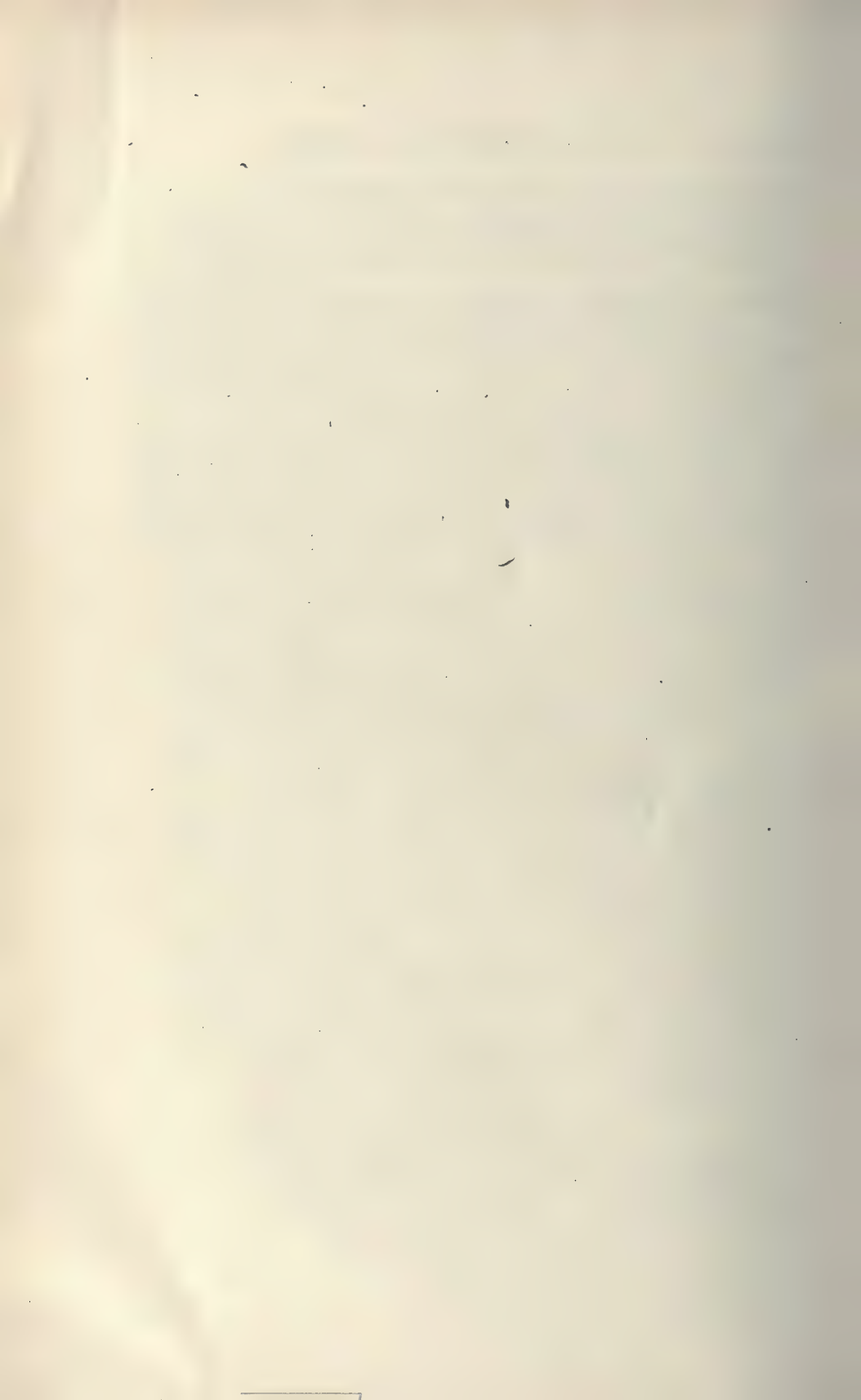
♀.—Length 5 mm. or rather more. Robust, with wide abdomen; head and thorax dark bluish green, front and vertex dull, mesothorax and scutellum highly polished, with very little hair; head broad; labrum pallid, with a deep dark pit; mandibles pallid, black at apex and red subapically; cheeks hairy, entirely dark; clypeus and triangular lateral face-marks very pale yellowish, the clypeus with two broad black bars, straight on inner side and convex on outer, not reaching upper or lower margin; no supraclypeal mark; upper border of prothorax entirely dark, but tubercles pale yellow; metathorax bluish, the upper surface shining but not polished; tegulæ pale brown; wings clear hyaline, nervures almost colorless, stigma very pale yellowish; marginal cell unusually long; legs black, the anterior and middle tibiæ in front, and knees, yellow; abdomen with yellow markings, consisting of a spot at each side of first segment, and interrupted bands on segments 2 to 5, these bent downward at the thick outer ends, that on second segment very widely interrupted, on fifth slightly; apex of fifth segment pale reddish; apical plate pale reddish basally, apically prolonged into a narrow piceous almost spine-like process; venter piceous, with a yellow spot in middle of third segment, fourth narrowly edged with yellow, and subemarginate in middle, margin of fifth segment and all of sixth pale ferruginous.

WYOMING: 1 ♀, Jackson, moderately moist pasture land, about 6300 ft. alt., July 1, 1920.

Differs from *P. affinis* Cresson by the polished mesothorax, and from *P. obscurata* Cresson by the clypeus, etc. The abdominal characters are very distinctive.

***Perdita (Cockerellia) wickhami*, new species**

♀.—Very close to *P. albipennis* Cresson, and at first sight appearing identical, but readily distinguished by the following characters. Mandibles dark red, blackened at base; clypeus with large yellow spots at lower corners, a square yellow mark in middle apically, and above and barely separated from the last a vertical yellow stripe, bulbous at base, then linear, and ending above like the head of a nail viewed laterally; scape yellow in front; flagellum bright deep ferruginous beneath, except basally; front entirely dull, without evident punctures, only the narrow orbital margins shining; tegulæ blackened anteriorly, pale red posteriorly; wings clear, but not strongly milky as in *albipennis*, stigma and nervures pale ferruginous, outer recurrent and transversocubital weak; disc of mesothorax more distinctly punctured; apical plate

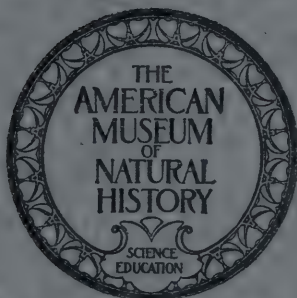


AMERICAN MUSEUM NOVITATES

No. 34

A FOSSIL MOTH FROM FLORISSANT, COLORADO

By T. D. A. COCKERELL



Issued March 29, 1922

BY ORDER OF THE TRUSTEES
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A FOSSIL MOTH FROM FLORISSANT, COLORADO

By T. D. A. COCKERELL

In 1909 a collection of fossils from the Miocene shales of Florissant, Colorado, was obtained by Messrs. Sternberg, Duce, and Rusk, and transmitted to The American Museum of Natural History. The new species were described by the present writer in the Bulletin of the American Museum, XXV (1910), with the exception of a moth, which was retained with the expectation that it would be described by another. More than ten years have passed and, as the moth has never been recorded, it seems desirable to offer a description. It is represented by a single anterior wing, but this is unusually well preserved. It is a member of the Geometridæ and, although its generic position, in the absence of antennæ, palpi, etc., must remain somewhat uncertain, it appears to fall in the large modern genus *Hydriomena* of Hübner.



Fig. 1. Fossil Moth, *Hydriomena* (?) *protrita*. Enlarged.

Hydriomena (?) *protrita*, new species

Anterior wing, length 23 mm.; costa distinctly arched before apex; outer margin 14.5 mm., gently convex; hind margin 17 mm.; basal space somewhat pallid; subbasal line very faint, but apparently arched outward, its lower part directed basad, and sharply angled a short distance above hind margin, in the manner of *H. manzanita*

Taylor, except that the curve is less abrupt and the angle is more pronounced; antemedian band also formed after the manner of *H. manzanita*, but more distant from base of wing, with the outward curve broader and less abrupt, though the posterior curve or loop and the angle between the two are nearly the same in the two species; the costal region is strongly infuscated, the dark color being broken by the antemedian band, which appears as a pale subvertical line; near the end of the cell is a distinct discal spot or pair of short transverse bars, apparently representing the dark antemedian mark of *H. manzanita*; the postmedian line is not so far from the antemedian as usual and appears to be formed much as in *H. albifasciata* Packard, inwardly bounding the dark apical and outer marginal areas; the fringe on the outer margin is chequered, as in many species.

The specimen bears the number 14.

So far as it is possible to see, this insect is of an entirely modern type. It is the first American fossil geometrid. The fossil Lepidoptera of Florissant, so far as known at present, are as follows, extinct genera being marked with an asterisk.

BUTTERFLIES

PIERIDÆ

- Stolopsyche* Scudder*
- libytheoides* Scudder

LIBYTHEIDÆ

- Barbarothea* Scudder*
- florissanti* Scudder
- Prolibythea* Scudder*
- vagabunda* Scudder

NYMPHALIDÆ

- Prodryas* Scudder*
- persephone* Scudder

- Jupiteria* Scudder*
- charon* Scudder
- Lithodryas* Cockerell*
- styx* (Scudder)
- Apanthesis* Scudder*
- leuce* Scudder
- Chlorippe* Boisduval
- wilmattæ* Cockerell
- Nymphalites* Scudder*
- obscurum* Scudder
- scudderi* Beutenmüller
- and Cockerell

MOTHS

SATURNIIDÆ

- Attacus* (?)
- fossilis* Cockerell

GEOMETRIDÆ

- Hydriomena* (?)
- protrita* Cockerell

TORTRICIDÆ

- Tortrix* (?)
- florissantana* Cockerell
- destructus* Cockerell

ETHMIDÆ

- Ethmia* (?)
- mortuella* Scudder

FAMILY UNKNOWN (larva)

- Phylledestes* Cockerell*
- vorax* Cockerell

It will be noticed that the butterflies with one exception are assigned to extinct genera. The moths, on the other hand, are doubtfully referred to living genera. It is possible that if we knew the moths better, we could distinguish them from living genera; but it must be confessed that there is nothing in their appearance to suggest this.

AMERICAN MUSEUM NOVITATES

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A NEW FOSSIL RODENT FROM ECUADOR

By H. E. ANTHONY



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A NEW FOSSIL RODENT FROM ECUADOR

By H. E. ANTHONY

Mr. A. M. Tweedy, Resident Manager of the mines of the South American Development Company at Portovelo, Ecuador, who has given such great assistance to the expeditions of the American Museum in Ecuador, has added to the collections a most interesting genus of fossil rodents. He gave to Mr. George K. Cherrie, who was in charge of the Museum's late expedition to Ecuador, July 1921 to January 1922, parts of a skull and skeleton of a large hystricomorph rodent related, among fossil genera, to *Neoreomys* of the Santa Cruz beds, and among living forms to *Myocastor*. This material Mr. Tweedy secured from Señor Carrasco who owns a large hacienda near Nabon, Provincia del Azuay. The accompanying diagram will show the nature of the locality where this rodent was found (Fig. 1).

Nabon is in the interandean area, at an elevation of about 9000 feet. The region is open and treeless, the only forest being found in scattered clumps along the higher ridges to the east. Although this section has a

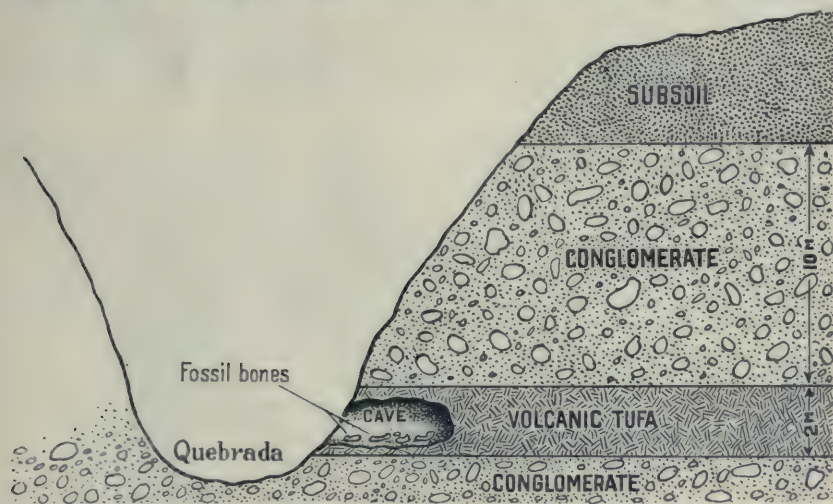


Fig. 1. Diagram based upon a sketch made by Mr. A. M. Tweedy, who was given the data by Señor Carrasco, the original collector of the fossil bones. The entrance to the cave was unearthed by a landslide.

comparatively long dry season and for most of the year is a region of extreme aridity, it is visited by torrential rains which erode the topography and scour out the ravines.

There is little doubt that this hystricomorph lived in the Pleistocene and such an interesting find leads one to hope that additional researches in Ecuador will bring to light more of the members of the preceding epochs.

I am indebted to Dr. W. D. Matthew, Curator of the Department of Palæontology of the American Museum, both for permission to describe this material which belongs in his department and for helpful discussions upon the material itself.

Drytomomys, new genus

A large hystricomorph rodent with very heavy incisors which have a thick cutting edge of enamel; molars rooted but fairly hypsodont, crown pattern made up of a series of deep reëntrant loops which become isolated by wear to form enclosed lakes, the normal number of which is three. There is a very deep fossa in the lateral face of the premaxillary.

Genotype: *Drytomomys æquatorialis*.

Drytomomys æquatorialis, new species

TYPE: No. 13219, Department of Vertebrate Palæontology, from Nabon, Prov. del Azuay, Ecuador, near the hacienda of Señor Carrasco, who took the bones from the cave. The type is a fragmentary skull, only the anterior portion of the cranium, carrying four molar teeth, and the anterior portion of the mandible, all of the teeth present. Accompanying these parts of the skull are a few fragments of limb bones, etc.

DESCRIPTION.—General proportions of cranium unknown; a very deep and apparently extensive fossa is indicated as lying in the lateral face of the rostrum, partly in the premaxillary, partly in the maxillary; incisive foramina probably of fair size; mandible robust and heavy, typically hystricomorph; incisors, upper and lower, very large and strong, proportionally enormous, rather deeper than broad and with well-developed cutting edge of heavy enamel; molar teeth rooted but with high crowns, four in each jaw; molar pattern simple, formed by a series of reëntrant loops of enamel which enter from the inside in the case of the upper molars, externally in the lower series; in the state of wear shown by the type most of these loops have been cut off to become completely detached lakes, elliptical in outline, while the tooth is sub-columnar in shape, completely encircled by enamel with scarcely any trace of the entering loop which was ancestral to the lake; true molars with typical pattern of three loops or lakes, lower premolars with two main lakes and three (left) or four (right) additional small lakes.

MEASUREMENTS.—Length of upper diastema, approximate, 32 mm.; dimensions of upper premolar, 7.8×8.7 ; dimensions of m^1 , 6.3×6.8 ; dimensions of m^2 , 7.2×7.5 ; length of mandibular toothrow, I-M₃, 60; crown length of mandibular molar series, 31.5; dimensions of lower premolar, 9.5×6.7 ; dimensions of m_1 , 6.2×7 ; dimensions

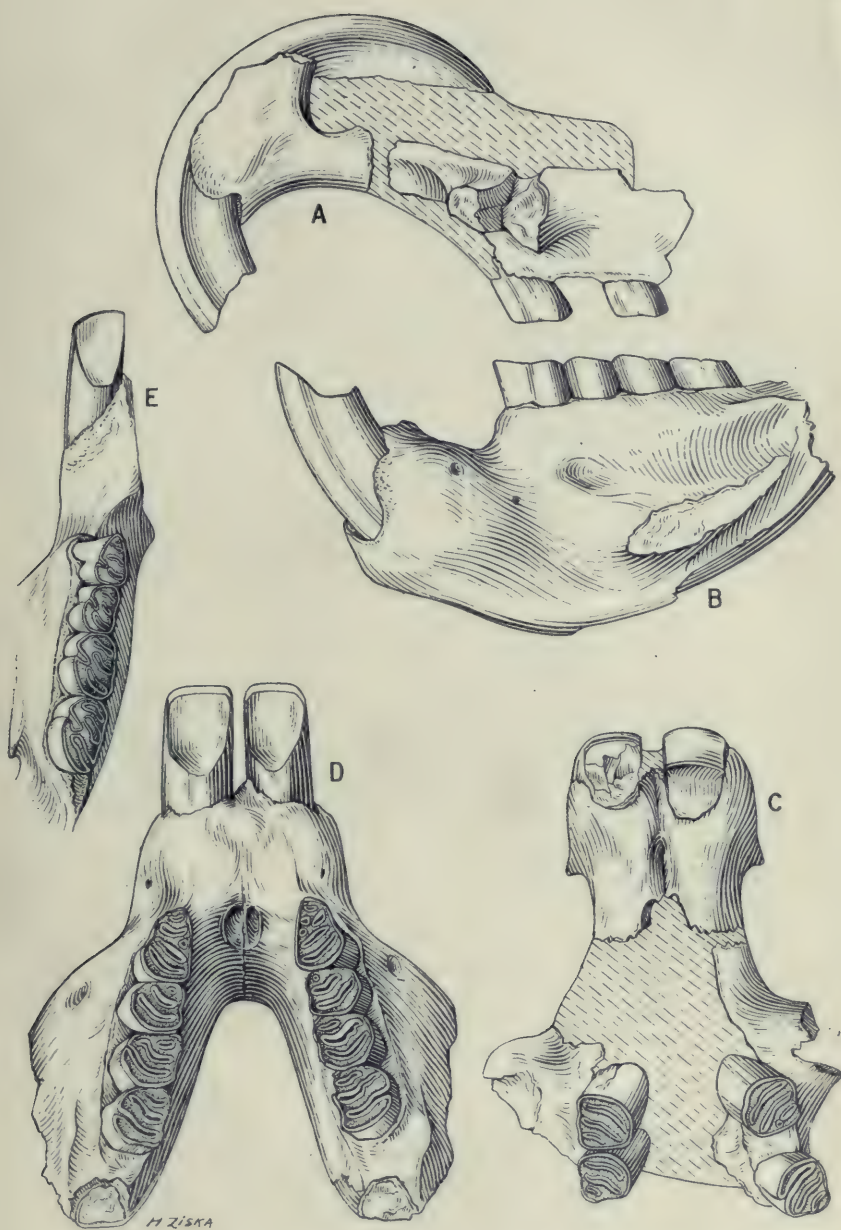


Fig. 2. A, B, C, D, *Drytomomys æquatorialis*, type specimen (A. M. Dept. Vert. Pal. 13219, Nat. Size). E. *Myocastor coypus* (A. M. Dept. Mam. 42751, Nat. Size).

of m_2 , 7.5×7.4 ; dimensions of m_3 , 8.8×7.5 ; breadth of upper incisor, 8.4; depth of upper incisor, 10.7; breadth of lower incisor, 8.4; depth of lower incisor, 10.2.

Drytomomys may be readily distinguished from all living rodents by its excessively developed incisors and by the molar pattern of completely isolated enamel lakes. While the skull is of about the same size as in the genus *Castor*, the incisors are actually twice as heavy and the enamel cutting edge is conspicuously heavier. It was because of this highly developed chisel-like incisor that the new genus was named *Drytomomys*, from the Greek *δρυτόμος*, a wood cutter and *μυς*, a mouse. If I am correct and this rodent was a woodcutter, it was even better equipped than the beaver, and bearing out this assumption is the presence of the deep lateral fossa of the rostrum which undoubtedly mark the attachment area of a greatly developed masseter muscle.

Apparently its closest affiliations with living rodents are with *Myocaster*. The molars of this genus, in the worn stage, show a fairly close approximation to the condition seen in the fossil genus. However, *Myocaster* molars have an extra reëntrant, internal in the upper series, external in the lower, which the *Drytomomys* tooth lacks. A specimen of *Myocaster* (No. 42751) has a molar tooththrow equal in length to that of the new genus, but the incisor teeth are about half as heavy.

Among fossil genera, *Neoreomys* is similar in many details to the Ecuador rodent but differs from it in the same characters as does *Myocaster*. In fact *Neoreomys* resembles *Myocaster* more closely than it does *Drytomomys*. No other genus of the Santa Cruz fauna bears as close a relationship to *Drytomomys* as does *Neoreomys*, but *Drytomomys* is so obviously related to this genus that it would appear perfectly at home in any collection from the Santa Cruz formation.

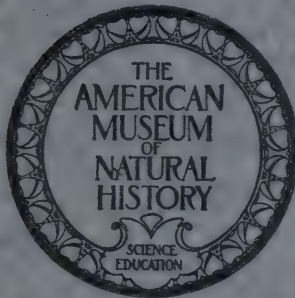
The fragments of limb bones present, the head of a humerus, distal end of an ulna, head of a femur and badly broken distal end of a tibia, all indicate an animal of robust and heavy build. These limb bones are very much larger than those of *Myocaster* and only a little less robust than those of *Hydrochaerus*.

AMERICAN MUSEUM NOVITATES

No. 36

BEEES OF THE GENUS *PANURGINUS* OBTAINED BY THE AMERICAN MUSEUM ROCKY MOUNTAIN EXPEDITIONS

By T. D. A. COCKERELL



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The bees recorded below were collected by Dr. Frank E. Lutz, except when the contrary is stated. I have included certain species of *Greeleyella* and *Hypomacrotera*, which are likely to be confused with *Panurginus*.

The genus *Panurginus* was first distinguished by Nylander in 1848, the type being *P. niger* Nylander, known from a female, 5 mm. long, collected by Sahlberg in Siberia. Nylander thought that the lack of copious pollen-carrying pubescence indicated a parasitic mode of life and, on this ground, separated the genus from *Panurgus*. The hair on the legs was, however, more abundant than that on the body. When Friese revised the Palæarctic *Panurginæ* in 1901, he had not seen *P. niger*, nor have any additional specimens been collected, so far as I am aware. The species is not in the British Museum, at Oxford, or in any of the American collections. The precise definition of *Panurginus*, therefore, remains somewhat uncertain, though it is probable that *P. niger* belongs to the genus as we now understand it.

F. Morawitz in 1876 founded a genus *Epimethea* on certain species differing from *Panurginus* in having yellow tegumentary markings on the abdomen and other parts of the body. *E. variegata* F. Morawitz may be taken as the type. It is recorded as occurring in the Caucasus and in Algeria. Probably *Epimethea* should be recognized as a genus but, although I have seen *E. variegata* in the British Museum, I have never made a close examination of any species of this group.

In 1894 Gribodo based his genus *Scrapteroides* on *S. difformis* Gribodo, which is now considered identical with *Panurginus albopilosus* (Lucas), a species of Spain and Algeria. I possess this species and find that it has a black face in the male and that the first recurrent nervure falls considerably basad of the first intercubitus (transversocubital). In these respects it resembles our American *P. atriceps* (Cresson), but the latter has a much longer flagellum in the male.

Panurginus is confined to the Palæarctic, Nearctic, and Neotropical Regions. If we exclude *Epimethea* (6 species), *Greeleyella*, and *Pseudopanurgus*, we find that, as at present known (including the species de-

scribed below), *Panurginus* has 51 Nearctic, 25 Neotropical, and only 20 Palearctic species. In the Swiss Alps and adjacent regions one may find *P. montanus* Giraud (1861) visiting flowers of *Ranunculus* and *Hieracium*. But the collector who would obtain other species has to travel far—to Spain for *P. albopilosus* Lucas and *P. hispanicus* Giraud, to northern Sweden for *P. romani* Aurivillius, to Russia for *P. lactipennis* Friese¹ and *P. sculpturatus* Morawitz. Contrast with this the abundance of species in our Rocky Mountain country, which appears to be the headquarters of the genus. In Asia, species occur in Japan (*P. crawfordi* Cockerell) and China (*P. nitidulus* Morawitz, *P. nigripes* Morawitz, *P. picitarsis* Cockerell), but we do not find them in the typical Oriental tropics. In America, on the other hand, they occur in the moist tropics, as in the "Tierra caliente" of Mexico (*P. bidentis* Cockerell) and in Brazil (*P. solani* Ducke). Nevertheless, the strictly tropical species are not very numerous.

If we are surprised that the Central European *P. montanus* has not produced any segregates, we must note that our closely analogous species, *P. cressoniellus*, is also without a series of closely related forms. These bees are indiscriminate feeders on a considerable series of flowers, and it appears to be true that oligotropic habits favor the evolution of new species. We know that species of *Greeleyella* and *Hypomacrotera* are oligotropic and there are reasons for regarding several species of *Panurginus* as such, but the subject requires much more minute study. In general sweeping, it is easy to obtain from a clump of flowers bees which were not actually feeding on the flowers cited, and even oligotropic bees wander from their proper plants at times.

The collections of Dr. Lutz greatly increase our knowledge of the species and distribution of western *Panurginus*, but it is evident that, with all that has been done, we still have but an imperfect knowledge of this rich fauna.

***Panurginus irregularis*, new species**

COLORADO: 2 ♂, Boulder, about 5300 ft. alt., on plains, August 12, 1919.

Taken with *P. piercei* Crawford and *P. nebrascensis* Crawford. Related to *P. horizontalis* Swenk and Cockerell, but easily known by the dark tubercles and other characters

♂.—Length about 6 mm.; slender. Black; mandibles (except apex), labrum, and face up to level of antennae bright yellow, upper level of yellow irregular, denticulate, with a slender process on each side a little way up orbits. Second joint of labial palpi much longer than third; third and fourth subequal. Process of labrum very broad, truncate. Front dull, vertex shining, with distinct punctures. Scape yellow

¹The British Museum has specimens of *P. lactipennis* from Persia.

in front; flagellum pale ferruginous beneath except base and last joint, the latter abruptly dark. Thorax above with thin dull white hair; mesothorax and scutellum polished, with sparse distinct punctures; area of metathorax with fine rugæ; tubercles black (yellow in *P. horizontalis*); tegulæ testaceous. Wings strongly dusky; nervures fuscous, stigma dilute reddish; second submarginal cell much shorter than first, receiving the recurrent nervures about equally distant from base and apex. Femora black, yellow at apex; tibiæ yellow, the anterior ones with a black patch behind, middle and hind ones each with two black marks (tibiæ thus as in *P. citripes* Ashmead, but face-marks different); tarsi yellow, reddish apically; abdomen with fine punctures. The clypeus has a fine median groove.

***Panurginus altissimus*, new species**

COLORADO: 1 ♂ (Type), 2 ♀, Ouray, about 8000 ft. alt., July 11, 1919, collected by Herbert F. Schwarz; 1 ♀, Ouray, about 8500 ft. alt., sweeping grass among Douglas fir, aspen, scrub oak, etc., July 11, 1919.

♂ (Type).—Length about 7 mm., rather slender. Black; mandibles black; labrum black, but the process pale yellow, with sloping sides, and the binodose or subemarginate apical margin black; clypeus, irregularly subtriangular supraclypeal mark and large triangular lateral face-marks (almost reaching upper corners of clypeus) sulphur-yellow. Clypeus sparsely punctured, and with a faintly indicated median groove. Scape black; flagellum black, very obscurely reddish beneath. Mesothorax and scutellum polished, sparsely punctured; area of metathorax finely plicatulate; tegulæ rufous, piceous in front. Wings dusky, especially the broad apical margin; stigma and nervures dark brown; first submarginal cell about as long as second on lower side; first recurrent nervure joining second submarginal cell a long way from base, fully three times as far as second from apex. Legs (including anterior tibiæ) black, small joints of tarsi becoming brownish apically. Abdomen ordinary, with very fine punctures.

♀.—Length about 7 mm. Black without light markings. Mesothorax highly polished, almost impunctate.

The female is so like *P. piercei* Crawford that I should have regarded it as a mountain race with dusky wings, but the male is much more different.

***Panurginus opaculus*, new species**

ARIZONA: 1 ♀ (Type), Mud Springs, Pine Canyon, Sta. Catalina Mts., about 6800 ft. alt., among oak, pinyon, juniper, walnut, etc., July 17–20, 1916; 1 ♀, same locality, August 19, 1916.

♀.—Length about 5 mm. Black. Clypeus and supraclypeal area shining, rather closely punctured. Antennæ dark, the flagellum very obscurely brownish beneath. Mesothorax dull, with a strong median groove; scutellum shining, flattened on disc, finely punctured; tegulæ rufous. Wings dusky, stigma and nervures very dark brown.

Very close to *P. pauper* Cresson (specimens collected by Banks at Ceanothus, Falls Church, Va., compared) and at first sight appearing identical, but distinguished by the dark antennæ, granular basal area of metathorax (plicatulate in *pauper*), and very broadly truncate process of

labrum (rounded in *pauper*). It is larger than *P. flavotinctus* (Cockerell) and has the process of labrum more broadly truncate (*flavotinctus* having the labrum intermediate between *pauper* and *opaculus*).

***Panurginus pernitens*, new species**

ARIZONA: 1 ♀, S. E. of Kitt's Peak, Baboquivari Mts., about 4000 ft. alt., among mesquite with considerable oak, August 1-4, 1916.

♀.—Similar to *P. opaculus*, and at first glance appearing identical, but easily distinguished by the rather oblong head, with facial quadrangle considerably longer than broad. Clypeus and supraclypeal area elevated, forming a very obtuse ridge, with a few scattered punctures on a highly polished surface. Process of labrum narrower than in *P. pauper*, rounded at end. Area of metathorax minutely, microscopically plicatulate. Stigma rather dilute reddish-sepia. Ventral abdominal segments pale reddish basally. Compared with *P. pauper*, the wings are longer, hyaline (not dusky as in *pauper*) and the stigma is smaller. The mesothorax, though excessively finely punctured, is somewhat shining, and the scutellum is similarly sculptured. The flagellum is bright ferruginous beneath except at base. The insect is much larger than *P. flavotinctus*.

The following key separates the females of the *pauper* group.

1. Flagellum entirely dark.....*opaculus* Cockerell.
Flagellum red beneath except at base.....2.
2. Facial quadrangle much longer than broad.....*pernitens* Cockerell.
Facial quadrangle about square.....3.
3. Larger; process of labrum rounded.....*pauper* (Cresson).
Smaller; process of labrum subtruncate.....*flavotinctus* (Cockerell).

***Panurginus porterae* Cockerell**

ARIZONA: 1 ♂, 1 ♀, near Soldier's Camp, Sta. Catalina Mts., about 9100 ft. alt., at flowers of *Oenothera*, July 14, 1916. COLORADO: 2 ♂, Estes Park, one, July 23, 1916, collected by A. E. Butler, the other August 18, 1919, collected by Herbert F. Schwarz.

The Arizona female cannot be distinguished from *porterae* from Beulah, New Mexico. The Arizona male is smaller, and has the eyes very dark gray instead of green. This male certainly appears to be conspecific with the form I recorded (Ann. Mag. Nat. Hist., April 1916, p. 279) from Pecos, New Mexico, as *P. picipes* Cresson. The original *picipes* was based on two males collected by Belfrage in Texas. Mr. W. J. Fox kindly sent me a drawing of the face of Cresson's type, and it shows the band-like lateral marks sharply truncate above, with the inner corner of the truncation a little higher than that on the orbit. My so-called *picipes* have the lateral marks pointed on or very close to the orbital margin and are nearer to *porterae*. It is possible that they should be separated, but at present I regard them as a form of that species. The

Arizona male has the basitarsi black; the hind ones are largely testaceous in the Pecos specimens.

Panurginus perlævis (Cockerell)

COLORADO: 1 ♂, 4 ♀, Wray, about 3700 ft. alt., August 17-19, 1919. One female was collected by Pearce Bailey, Jr. A male and female were at *Helianthus*.

This is very close to *P. piercei* Crawford, but amply distinct. The females may be separated thus:

Flagellum beneath bright ferruginous in middle and dark at ends; clypeus not depressed in middle and may be faintly carinate; supraclypeal area with many punctures.....*perlævis*.

Flagellum beneath dusky reddish from near base to apex; clypeus depressed in middle; supraclypeal area with very few punctures.....*piercei*.

Male *perlævis* differs from *piercei* by lack of the median groove on clypeus. There is only a small yellow triangle on the supraclypeal area, and between this and the lateral marks are large black areas (the outline of the yellow forming a broad W), while the lateral marks are obliquely truncate above. The flagellum is light yellowish-ferruginous beneath, except the last two joints and extreme base. The hind tibiæ have about the basal half yellow (less in *piercei*), and the wings are not dusky. The process of labrum is yellow with a black apical margin, very broadly truncate, the truncation somewhat concave.

The type of *P. perlævis* was collected on *Helianthus* at Las Cruces, New Mexico.

Panurginus piercei Crawford

COLORADO: 1 ♂, Boulder, about 5300 ft. alt., on the plains, August 7-12, 1919.

Panurginus nebrascensis Crawford

COLORADO: 2 ♂, Boulder, about 5300 ft. alt., on the plains, August 7-12, 1919; 1 ♂, Denver, August 28, 1919, collected by Barbara M. and Marjorie D. Schwarz.

Crawford (1912, Canad. Ent., XLIV, p. 368) states that the tibiæ are completely annulate with black. They are not so in the Boulder specimens, nor in a cotype received from Crawford.

Panurginus atricornis (Cresson)

COLORADO: 2 ♂, 4 ♀, Estes Park, two females collected by Herbert F. Schwarz, August 13-14, 1919, the remainder by A. E. Butler, July 19, 1916, at about 7800 ft. alt.

The males agree with *P. atricornis* from Beulah, New Mexico, and Viereck recognized this as *atricornis* after seeing Cresson's type. Cresson's description agrees, except that he says the face-marks are white,

perhaps in consequence of using artificial light. The females differ from *P. porteræ* by having the highly polished mesothorax almost impunctate. Many years ago Mr. Fox sent me a supposed ♀ *P. ornatipes*, from Colorado, out of the Cresson series. It is not *ornatipes*, but *atricornis*.

***Panurginus renimaculatus* (Cockerell)**

WYOMING: 1 ♀, Sheridan, collected by C. W. Metz.

***Panurginus didirupa* Cockerell**

COLORADO: 1 ♂, Estes Park, August 17, 1919, collected by Herbert F. Schwarz; 2 ♂, 2 ♀, Ward, August 8–10, 1919, the females collected by Miss Sara Branham; 1 ♂, Elbert Creek, near Electric Lake, La Plata Co., about 10,000 ft. alt., June 30, 1919. IDAHO: 1 ♀, near Montpelier, about 6100 ft. alt., July 6, 1920.

The female is smaller than *P. porteræ*, with the sides of face shining and finely punctured, and the wings strongly brownish.

***Panurginus bakeri* (Cockerell)**

ARIZONA: 1 ♀, southwest end of Coyote Mts., about 3500 ft. alt., among mesquite, palo verde, etc., August 4–7, 1916; 1 ♀, Bear Wallow, Sta Catalina Mts., about 8100 ft. alt., near Soldier's Camp, among Douglass firs, etc., at (?) *Pseudocymopterus montanus*, July 13, 1916. COLORADO: 1 ♀, Ouray, about 10,000 ft. alt. on Summit Road, July 13, 1919; 1 ♀, in a meadow at Warren Lake, near Aspen, about 10,800 ft. alt., July 26, 1919; 1 ♂, Electra Lake, near Durango, about 8400 ft. alt., at *Potentilla filipes*, June 29, 1910; 3 ♀, 1 ♂, Leadville, about 10,200 ft. alt., in the town, August 4, 1919, collected by Bailey, Schwarz, and Lutz; 1 ♂, 1 ♀, Ward, August 9, 1919, collected by Sara Branham; 3 ♂, 5 ♀ (one female with two female stylopids, *Crawfordia*), Tennessee Pass, about 10,300 ft. alt., August 1–8.

For a description of the female, see Cockerell, 1910, *Psyche*, XVII, p. 245.

***Panurginus cressoniellus* Cockerell**

COLORADO: 2 ♀, Ward, about 9300 ft. alt. near town, August 9, 1919; 2 ♀, Pagosa Springs, one along west bank of river below town, about 7200 ft. alt., and one in U. S. Forest, about 7400 ft. alt., June 21–24, 1919.

The female flagellum is mainly ferruginous beneath.

***Panurginus cressoniellus* variety *calochorti* Cockerell**

COLORADO: 39 ♀, 17 ♂, Tennessee Pass, about 10,300 ft. alt., July 30–August 8,¹ various collectors; 5 ♀, Ouray, about 10,000 ft. alt., on the Summit Road, July 13, 1919, collected by Messrs. Schwarz and Lutz; 1 ♀ (first recurrent vein considerably basad of the first transversocubital), Malta, about 10,000 ft. alt., August 4, 1919; 1 ♂, Elbert Creek, La Plata County, about 10,200 ft. alt., June 30, 1919; 5 ♀, Estes Park, about 7700 ft. alt., July 19, 1916, collected by A. E. Butler.

¹Females abounded at the beginning of August, males appeared about a week later.

The female flagellum is dark. The Ward specimens of *P. cressoniellus* cited above come from almost exactly the type locality of variety *calochorti*. The *calochorti* form is the prevalent one in Colorado, especially at high altitudes.

About half the Tennessee Pass specimens have the first recurrent nervure more or less basad of the first transversocubital, and so should fall with the form named *verus*. The original type of *P. verus* Cockerell distinctly differs in some other respects, especially in having the upper apical corner of marginal cell rounded, the cell not sharply truncate as in all these Colorado insects. It is quite certain that the bees here referred to *calochorti* all belong together, but as among this large series I cannot match the type of *P. verus*, it remains at least possible that the latter represents a different species, not including the specimens later referred to it. See also Entomological News, XXIII (1912), p. 445, where it was assumed that the later discovered specimens were properly referred to *verus*.

***Panurginus lutzæ*, new species**

COLORADO: 1 ♀, La Junta, along the road between irrigated fields, near to wn about 4100 ft. alt., August 12, 1920, collected by Mrs. F. E. Lutz.

♀.—Length about 6.4 mm. Black, without light markings, excepting pale yellow dots on anterior and middle knees. Thorax above with abundant, stiff, erect pale brown pubescence, not hiding the surface; vertex with similar pale brownish hair. Head ordinary, shining, facial quadrangle broader than long; tufts of whitish hair at extreme sides of clypeus below; mandibles dark, reddened subapically, simple, somewhat elbowed externally, the apical part of the right one densely rugoso-punctate above; labial palpi rather short, the second joint not much longer than the third; process of labrum very broad, subtruncate, the margin gently rounded; clypeus and adjacent parts highly polished, with sparse punctures; clypeus with a large but shallow circular median depression; facial foveæ with the upper end diverging from the orbits; flagellum dusky reddish beneath except at base. Mesothorax and scutellum shining, without evident punctures under a lens, though the microscope shows that the numerous hairs arise from small punctures; metathorax shining, the basal area reduced to a narrow transverse rugulose channel; tegulæ reddish-testaceous. Wings hyaline, very faintly brownish; stigma large, solid reddish brown, nervures pale brown; first recurrent joining second submarginal cell at a distance from its base much greater than half length of first transversocubital. Legs ordinary, with pale hair, middle basitarsi comparatively short and broad. Abdomen shining, the apex with white hair.

On account of characters of sculpture and wings, it does not seem possible that this is the female of *P. expallidus* Swenk and Cockerell or *P. horizontalis* Swenk and Cockerell, described from males collected in Nebraska. In many respects, it resembles *P. piercei* Crawford, but the latter is considerably larger, with much lighter and redder stigma. I

take it that *P. lutæ* is a comparatively recent segregate from the *piercei* type, adapted to a different flower. Compared with *P. innuptus* Cockerell, the area of metathorax and other characters are quite distinctive.

***Panurginus pulchricornis*, new species**

COLORADO: 1 ♀, Tennessee Pass, about 10,500 ft. alt., August 6-8, 1920.

♀.—Length about 7 mm. Black, similar to *P. atricornis* Cresson, but the flagellum is ferruginous beneath except at base and apex, and the stigma is piceous, appearing black by reflected light. The process of labrum is broad, truncate, with the margin gently convex; in *atricornis* it is much narrower. The clypeus is very coarsely punctured though shining, without any smoother space in middle. The mesothorax and tegulæ are as in *atricornis*, but the thorax is considerably smaller. The area of metathorax is rather larger, entirely rugulose and opaque. The wings are conspicuously dusky. The apical plate of the abdomen is long, with straight sides.

***Panurginus ineptus*, new species**

COLORADO: 1 ♀, Tennessee Pass, about 10,500 ft. alt., August 6-8, 1920.

♀.—Length hardly 6 mm. Black, the head and thorax with scanty but long white hair; eyes dark gray; facial quadrangle somewhat broader than long, orbits converging a little below; mandibles reddened about middle; process of labrum broad and truncate; palpi and tongue short. Third antennal joint unusually short, not much longer than broad, and not as long as the next two together, though they are very short; flagellum dusky red beneath, including the last joint. Clypeus highly polished, with scattered punctures; supraclypeal area shining; vertex smooth, with very feeble punctures. Mesothorax shining, with very weak punctures, median groove strong; area of metathorax dull and granular, the heavy posterior rim feebly shining; mesopleura dullish above, more shining below; tegulæ piceous with a large pallid discal area. Wings brownish hyaline, stigma and nervures dilute reddish brown; stigma robust; marginal cell broadly, obliquely truncate, the angles not rounded; first submarginal cell much longer than second; first recurrent nervure going only just beyond the first transversocubital. Legs black, with pale hair, that on anterior basitarsi thick and pale straw-yellow. Abdomen highly polished, shining throughout, with only scattered very minute piliferous punctures; apex with shining white hair.

An isolated species.

***Hypomacrotera callops* Cockerell and Porter**

COLORADO: 2 ♀, Regnier, Baca County, about 4400 ft. alt., in Gallinas Canyon, at *Quincula lobata*, June 8, 1919.

***Hypomacrotera callops persimilis* Cockerell**

ARIZONA: 2 ♀, 2 ♂, San Xavier Mission, near Tucson, on flood-plains of Santa Cruz, at *Physalis angulata*, July 24, 1916.

The eyes are dark brown in both sexes; in typical *persimilis* from Phoenix, Arizona, they are blue-green in both sexes. The supraclypeal mark of the male is well-developed.

Greeleyella beardsleyi Cockerell

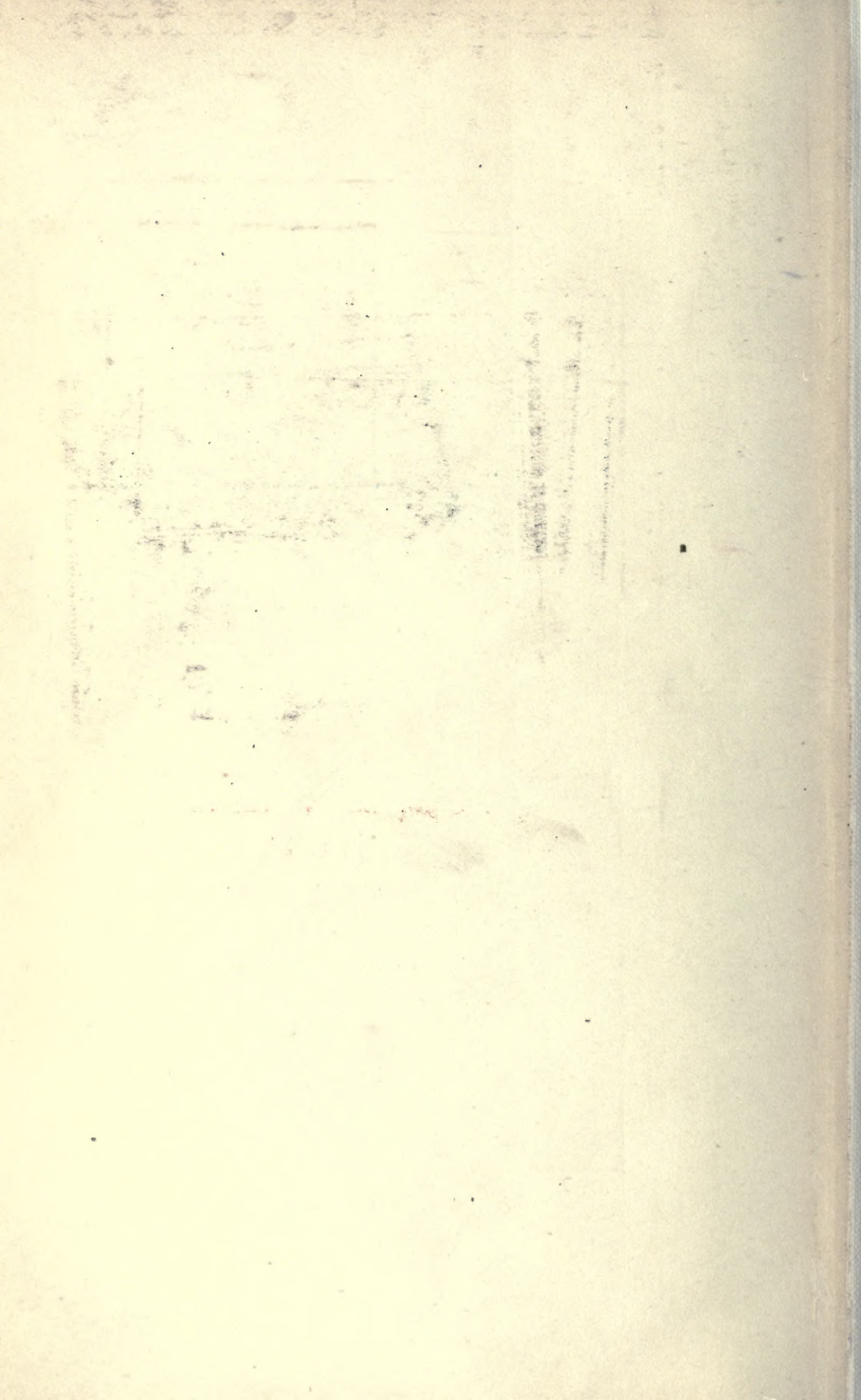
COLORADO: 2 ♂, 11 ♀, Regnier, Baca County, about 4400 ft. alt., at *Quincula lobata*, *Sphæralcea coccinea*, and *Monarda pectinata*, June 6-9, 1919.

According to my experience, this species is oligotropic on *Malvastrum coccineum* (*Sphæralcea coccinea* of Rydberg).

The following key will facilitate the separation of the species recorded above.

- Males.....1.
 Females.....13.
1. Light color of face confined to clypeus.....2.
 Light color of face not confined to clypeus.....4.
 2. Tibiæ red and yellow; first recurrent nervure meeting first intercubitus.
 G. beardsleyi Cockerell.
 - Tibiæ black, or at most anterior ones pale in front.....3.
 3. First recurrent nervure going far beyond first intercubitus; mesothorax dullish.
 P. bakeri Cockerell.
 - First recurrent meeting first intercubitus, or falling basad of it; mesothorax polished.....*P. cressoniellus* Cockerell.
 4. Supraclypeal mark wholly absent; labrum black, flagellum dark.....5.
 Supraclypeal mark at least represented by a spot.....6.
 5. Larger; clypeus with two black spots; upper corner of lateral face-marks forming a larger angle.....*P. porteræ* Cockerell.
 - Smaller; clypeus without black spots; upper corner of lateral face-marks forming a smaller angle.....*P. porteræ* Cockerell, variety (Arizona).
 6. Anterior wings with conspicuous apical cloud; head very broad.
 H. callops persimilis Cockerell.
 - Anterior wings without such a cloud.....7.
 7. Scape yellow in front.....8.
 Scape wholly black.....9.
 8. Face chrome-yellow.....*P. irregularis* Cockerell.
 - Face pale primrose-yellow.....*P. nebrascensis* Crawford.
 9. Flagellum clear reddish orange beneath, except at base and apex.
 P. perlævis (Cockerell).
 - Flagellum dark or dusky beneath.....10.
 10. Lateral face-marks forming practically right angles on orbits above.
 P. piercei Crawford.
 - Lateral face-marks ending above in acute angles.....11.
 11. Anterior tibiæ dark.....12.
 Anterior tibiæ light in front; eyes green.....*P. didirupa* Cockerell.
 12. Small joints of tarsi red.....*P. atricornis* (Cresson).
 - Small joints of tarsi more slender, not red.....*P. altissimus* Cockerell.
 13. (Females) A light patch in middle of face; tarsi ferruginous.
 P. renimaculatus Cockerell.

- No light patch on face.....14.
14. Anterior tibiae pale yellowish red in front; flagellum red beneath.
G. beardslayi Cockerell.
 Anterior tibiae dark in front.....15.
15. Mandibles bright red in middle; mesothorax highly polished; stigma very slender, pale with dusky margin.....*H. callops* Cockerell and Porter.
 Mandibles dark, or if partly reddened, mesothorax or stigma different....16.
16. First recurrent nervure joining first intercubitus, or falling basad of it.....17.
 First recurrent nervure going beyond first intercubitus.....18.
17. Flagellum red beneath.....*P. cressoniellus* Cockerell.
 Flagellum entirely dark.....*P. cressoniellus calochorti* Cockerell.
18. Mesothorax dull or dullish, not highly polished; smallish species.....19.
 Mesothorax polished; mainly larger species.....21.
19. Tegulae rufotestaceous.....20.
 Tegulae piceous.....*P. bakeri* Cockerell.
20. Clypeus and supraclypeal area punctured, dullish; stigma very dark.
P. opaculus Cockerell.
 Clypeus and supraclypeal area highly polished; stigma dilute brown.
P. pernitens Cockerell.
21. Mesothorax with conspicuous fulvous hair; tegulae rufotestaceous.....22.
 Mesothorax without such hair.....23.
22. Larger; mesothorax with conspicuous punctures.....*P. porterae* Cockerell.
 Smaller; mesothorax without conspicuous punctures....*P. lutzæ* Cockerell.
23. Flagellum black; mesothorax highly polished, without conspicuous punctures;
 stigma dark brown; wings strongly dusky.....*P. atricornis* (Cresson).
 Flagellum at least largely pale beneath, or if somewhat dusky, mesothorax
 evidently punctured.....24.
24. Stigma reddish brown, large and broad; flagellum light yellowish-ferruginous
 beneath, except base and apex; base of metathorax distinctly plicatulate.
P. perlævis (Cockerell).
 Stigma more slender, dark or reddish; flagellum dusky beneath, or if paler,
 mountain forms, smaller than *perlævis*, with base of metathorax granular.25.
25. Stigma piceous; first recurrent nervure going far beyond first intercubitus;
 flagellum red beneath except at ends.....*P. pulchricornis* Cockerell.
 Stigma rather dilute brown.....26.
26. First recurrent going only just beyond first intercubitus; flagellum pale beneath;
 rather small species.....*P. ineptus* Cockerell.
 First recurrent going considerably beyond first intercubitus.....27.
27. Mesothorax hardly at all punctured; sides of face shining, feebly punctured.
P. allissimus Cockerell.
 Mesothorax evidently punctured; sides of face distinctly punctured.
P. didirupa Cockerell.



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